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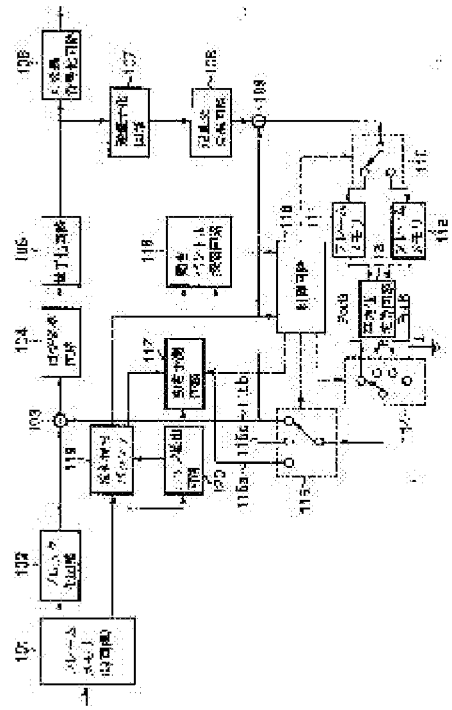
(71)Applicant : CANON INC
(72)Inventor : HAMANAKA AKIYOSHI

(54) CODING APPARATUS, METHOD OF CODING AND STORAGE MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To improve the coding processing time or motion compensation accuracy by using shape information of an image with contour information when coding this image, and also to enable coding of an image which does not have contour information by extracting the contour information from this image to use the contour information.
SOLUTION: The presence/absence of information according to blocked image data to be encoded is confirmed. When the presence/absence of the information is not detected, contour information with respect to the blocked image data is formed and predicted values of motion vectors of the blocked image data are calculated, and a first region which most resembles the blocked image data to be coded is determined. Motion vectors of the blocked image data to be coded are calculated, difference block value blocks are encoded, and the coded difference values are decoded to be re-stored in the storage means.



CLAIMS

[Claim(s)]
[Claim 1]It is coding equipment characterized by comprising the following which codes to image data of each frame of video, A storing means which stores the 2nd frame that is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said storing means, and Said 2nd frame, A division means to divide the 1st frame into a block which has predetermined size, An extraction means to extract profiling information of an object contained in said 1st frame and said 2nd frame for said every division means **** block, Profiling information of an object contained in said 1st frame extracted by said extraction means, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction means which predicts a motion vector from said 1st frame to said 3rd frame that is a next frame in time than said 1st frame by a block unit using the motion vector concerned, and said 3rd frame.
A block shown by a motion vector predicted by said prediction means.
An encoding means which codes to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[Claim 2]The coding equipment comprising according to claim 1:
A decision means which judges whether, as for said extraction means, profiling information of an object exists in said 1st frame and said 2nd frame further.
An edge detection means which performs edge detection to said 1st frame and said 2nd frame, and makes the edge detection result concerned said profiling information of each frame by said decision means when profiling information of an object does not exist in said 1st frame and said 2nd frame.

[Claim 3]The coding equipment according to claim 2, wherein said edge detection means generates said profiling information of each frame using edge information generated by performing DCT transformation to said 1st frame and said 2nd frame, and evaluating each DCT coefficient.
[Claim 4]The coding equipment according to claim 2, wherein said edge detection means generates profiling information of each frame using edge information which asked for total of said 1st frame, said 2nd frame, and each luminance value, and was generated using this total.
[Claim 5]Coding equipment given in any 1 paragraph of claims 1 thru/or 4 characterized by comprising the following.
An area setting means by which said prediction means sets further a field which has

predetermined size focusing on the search starting point based on a motion vector of a noticing block from said 2nd frame to said 1st frame as said 3rd frame.
A block specifying means which pinpoints said noticing block and a most similar field as a prediction block to said noticing block in a field by said area setting means.
A calculating means which computes a motion vector to said prediction block specified by said block specifying means from said noticing block.

[Claim 6]Coding equipment given in any 1 paragraph of claims 1 thru/or 5 said each frame's having a layered structure and being able to memorize said profiling information for every hierarchy.
[Claim 7]It is an encoding method characterized by comprising the following which codes to image data of each frame of video, A storing process which stores in a predetermined storing means the 2nd frame that is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A partitioning process which divides the 1st frame into a block which has predetermined size, An extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction process which is a next frame using the motion vector concerned in time than said 1st frame to said 1st frame of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame.
A block shown by a motion vector predicted at said prediction process.
A coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[Claim 8]The encoding method comprising according to claim 7:
A deciding step which judges whether, as for said extraction process, profiling information of an object exists in said 1st frame and said 2nd frame further.
An edge detection process of performing edge detection to said 1st frame and said 2nd frame, and making the edge detection result concerned into said profiling information of each frame according to said deciding step when profiling information of an object does not exist in said 1st frame and said 2nd frame.

[Claim 9]The encoding method comprising according to claim 7 or 8:
A field setting-out process that said prediction process sets further a field which has predetermined size focusing on the search starting point based on a motion vector of a noticing block from said 2nd frame to said 1st frame as said 3rd frame.
A block specific process of pinpointing said noticing block and a most similar field as a prediction block to said noticing block in a field by said field setting-out process.
A calculating process which computes a motion vector to said prediction block specified by said block specific process from said noticing block.

[Claim 10]It is a storage characterized by comprising the following which stores a program code which functions as coding equipment which codes to image data of each frame of video, A program code of a storing process which stores in a predetermined storing means the 2nd frame

that is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A program code of a partitioning process which divides the 1st frame into a block which has predetermined size, A program code of an extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. . It is a next frame from said 1st frame using the motion vector concerned in time than said 1st frame. A program code of a prediction process of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame.
A block shown by a motion vector predicted at said prediction process.
A program code of a coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[Claim 11]The storage comprising according to claim 10:
A program code of a deciding step which judges whether, as for a program code of said extraction process, profiling information of an object exists in said 1st frame and said 2nd frame further.
When profiling information of an object does not exist in said 1st frame and said 2nd frame according to said deciding step, A program code of an edge detection process of performing edge detection to said 1st frame and said 2nd frame, and making the edge detection result concerned into said profiling information of each frame.

[Claim 12]The storage comprising according to claim 10 or 11:
A program code of a field setting-out process that a program code of said prediction process sets further a field which has predetermined size focusing on the search starting point based on a motion vector of a noticing block from said 2nd frame to said 1st frame as said 3rd frame.
A program code of a block specific process of pinpointing said noticing block and a most similar field as a prediction block to said noticing block in a field by said field setting-out process.
A program code of a calculating process which computes a motion vector to said prediction block specified by said block specific process from said noticing block.

[Claim 13]Coding equipment which codes to image data of each frame of video, comprising:
An extraction means to extract profiling information of an object contained in each frame.
A detection means to detect a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction means, and an encoding means which carries out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection means.

[Claim 14]An encoding method which codes to image data of each frame of video, comprising:
An extraction process of extracting profiling information of an object contained in each frame.
A detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process, and a coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process.

[Claim 15]A program code of an extraction process of being a storage which stores a program code which functions as coding equipment which codes to image data of each frame of video, and extracting profiling information of an object contained in each frame, A program code of a detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process, A storage storing a program code of a coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to coding equipment which codes to the image data of each frame of video, a method for the same, and a storage.
[0002]
[Description of the Prior Art]An example of conventional coding equipment is shown in block drawing 7.
[0003]In drawing 7, the buffer memory for original image data and 702 701 A blocking circuit, A subtractor circuit and 704 for 703 an orthogonal transformation circuit and 705 a quantization circuit and 706 A variable-length-coding circuit, 707 -- an inverse quantizing circuit and 708 -- as for a frame memory and 713, an adder circuit and 710,714,715 are [a control circuit and 717] motion vector search circuits a mean value arithmetic circuit and 716 a selector switch and 711,712 an inverse-orthogonal-transformation circuit and 709.
[0004]In drawing 7, the original image data which is a coding subject is stored in the buffer memory 701, is read according to the demand from the control circuit 716, and can be carved into the block (size of nxm) of the size which is equivalent to the unit of coding by the blocking circuit 702.
[0005]All processings after this are performed by this block unit.
[0006]The blocked original image data (blocked image data) is inputted into the vector search circuit 717 in order to determine a motion vector (motion compensation).
[0007]An example of the motion vector searching method in the motion vector search circuit 717 is shown in drawing 8.
[0008]Coding object frame I [in / in drawing 8 (a) / the current time t] (t), reference frame I (t-1) to the coding object frame which showed drawing 8 (a) drawing 8 (b), and drawing 8 (c) show reference frame I (t-2) to the frame shown in drawing 8 (b). The block (block A) of a shadow area is made into the noticing block in I (t) in drawing 8 (a), and MVc is taken as the motion vector to the block A in I (t-1) of the block A in I (t). In drawing 8 (c), MVp is taken as the motion vector to the block A in I (t-2) of the block A in I (t-1).
[0009]Here, the search method of the motion vector MVc follows the following procedures.
[0010]First, the motion vector MVp shall be detected. And the position which shifted only MVp from the same position as the block A on I (t-1) is searched for, and let this position be the search start starting point.
[0011]Next, the difference absolute value sum which sets the range of predetermined size (retrieving range of a motion vector) as level and a perpendicular direction focusing on the search start starting point, is in this retrieving range and shifts 1 pixel of frames of the predetermined range at a time and for which it asks by the following formulas (each pixel of the

block A of sigma|I (t) - each within the limit pixel | of the predetermined range)
It calculates. And the difference absolute value sum of 1 pixel accuracy is compared, and the coordinate value (coordinate value of the position at the upper right of the frame of the range predetermined in the figure) which obtained the minimum is detected. And in within the limit [of said predetermined range] in order to raise the retrieval precision of a motion vector further, A virtual pixel (a pixel value is calculated from the surrounding pixel) is arranged between each pixel, origin twice the resolution of on imagination is prepared within the limit of said predetermined range as a result, and the difference absolute value sum for every size of the block A is calculated like **** within this limit. As a result, it can ask for the motion vector MVc by comparing two or more obtained difference absolute value sums, respectively, and detecting the coordinate value which obtained the minimum.
[0012]In the above motion vector heuristics, I (t-1) shown by drawing 8 (b), By control of the control circuit 716, each pixel of the above-mentioned predetermined range within the limit is read from the frame memory 711 or 712 one by one, and it is inputted into the motion vector search circuit 717 via the selector switches 714 and 715a.
[0013]At this time, with the above-mentioned example, the difference absolute value sum of each pixel of the predetermined range within the limit and the block A of I (t) which were inputted calculates, and, as a result, a motion vector is determined.
[0014]Next, blocked image data is inputted into the subtractor circuit 703. The predicted value (block decoded [local]) simultaneously specified in the motion vector called for in the motion vector search circuit 717 by control of the control circuit 716 is read from the frame memory 711 or 712, It is made to input into the subtractor circuit 703 via the selector switches 714 and 715b, and subtraction treatment is carried out from the blocked image data from the blocking circuit 702.
[0015]After the subtraction result in the subtractor circuit 703 is outputted as a prediction error of the data of an original image, orthogonal transformation of it is carried out in the orthogonal transformation circuit 704.
[0016]After being quantized in the quantization circuit 705, the prediction error by which orthogonal transformation was carried out in the orthogonal transformation circuit 704 is inputted into the variable-length-coding circuit 706, and is given the variable length code based on a predetermined function.
[0017]On the other hand, the prediction error after quantization processing in the inverse quantizing circuit 707 and the inverse-orthogonal-transformation circuit 708. After processing completely contrary to the quantization circuit 705 and the orthogonal transformation circuit 704 is performed, it is added by the same value as the value (predicted value) used when searching for a prediction error in the subtractor circuit 703, and in the adder circuit 709 as local decryption image data, The frame memory 711 or 712 memorizes via the selector switch 710.
[0018]The frame memory 711,712 is a frame memory with the function to memorize the image data by which local decoding was carried out as mentioned above per frame.
[0019]The block memorized by the frame memory 711,712 decoded [local], As mentioned above, by control of the control circuit 716 at the time of motion vector search. It is similarly outputted to the motion vector search circuit 717 to the adder circuit 709 via the selector switch 714,715c to the subtractor circuit 703 via the selector switch 714,715b via the selector switch 714,715a, respectively at the time of local decoding at the time of a prediction error operation.
[0020]
[Problem(s) to be Solved by the Invention]In [as explained above] conventional coding

equipment, Even when coding the picture which has information effective in a motion compensation like the configuration information (profiling information) which identifies a background region and an object image area as represented in MPEG-4 since there is no function to use the information which accompanies original image data, Since the above-mentioned information was not able to be used, it had become shortening of coding processing time, and a neck of improvement in motion compensation accuracy.
[0021]Then, this invention is made in view of the problem of an above-mentioned conventional example, and it is coding by using this configuration information in the case of the coding of a picture which has profiling information, and aims at raising coding processing time and motion compensation accuracy. Also to the picture which does not have profiling information, profiling information is extracted from this picture and it aims at enabling it to code similarly by using this profiling information.
[0022]
[Means for Solving the Problem]In order to attain the purpose of this invention, this invention coding equipment of the one this invention, A storing means which stores the 2nd frame that is coding equipment which codes to image data of each frame of video, and is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said storing means, and Said 2nd frame, A division means to divide the 1st frame into a block which has predetermined size, An extraction means to extract profiling information of an object contained in said 1st frame and said 2nd frame for said every division means **** block, Profiling information of an object contained in said 1st frame extracted by said extraction means, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction means which is a next frame in time than said 1st frame and which predicts a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising the following from said 1st frame using the motion vector concerned:
A block shown by a motion vector predicted by said prediction means.
An encoding means which codes to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0023]This invention an encoding method of the one this invention, A storing process which stores in a predetermined storing means the 2nd frame that is an encoding method which codes to image data of each frame of video, and is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A partitioning process which divides the 1st frame into a block which has predetermined size, An extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said frame 2 to said frame 1 by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction process which is a next frame in time than said frame 1 of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising the following from said 1st frame using the motion vector concerned:
A block shown by a motion vector predicted at said prediction process.
A coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0024]This invention a storage of the one this invention, It is a storage which stores a program code which functions as coding equipment which codes to image data of each frame of video, A program code of a storing process which stores in a predetermined storing means the 2nd frame that is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A program code of a partitioning process which divides the 1st frame into a block which has predetermined size, A program code of an extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. . It is a next frame from said 1st frame using the motion vector concerned in time than said 1st frame. A program code of a prediction process of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising:
A block shown by a motion vector predicted at said prediction process.
A program code of a coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0025]As for this invention, coding equipment of the one this invention is characterized by that coding equipment which codes to image data of each frame of video comprises the following.
An extraction means to extract profiling information of an object contained in each frame.
A detection means to detect a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction means.
An encoding means which carries out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection means.

[0026]As for this invention, an encoding method of the one this invention is characterized by that an encoding method which codes to image data of each frame of video comprises the following.
An extraction process of extracting profiling information of an object contained in each frame.
A detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process.
A coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process.

[0027]A storage of the one this invention is a storage which stores a program code which functions as coding equipment which codes to image data of each frame of video, A program code of an extraction process of extracting profiling information of an object contained in each frame, A program code of a detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process, A program code of a coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process was stored.
[0028]
[Embodiment of the Invention]According to an accompanying drawing, this invention is explained in detail according to a suitable embodiment below.

[0029][A 1st embodiment] The block diagram showing the composition of the coding equipment in this embodiment is shown in drawing 1.
[0030]In drawing 1, the frame memory for original images and 102 101 A blocking circuit, A subtractor circuit and 104 for 103 an orthogonal transformation circuit and 105 a quantization circuit and 106 A variable-length-coding circuit, 107 an inverse quantizing circuit and 108 an inverse-orthogonal-transformation circuit and 109 An adder circuit, 110,114,115 -- a selector switch and 111,112 -- as for a motion prediction circuit and 118, a mean value arithmetic circuit and 116 are [a profiling information buffer and 120] edge detection circuits a motion vector search circuit and 119 a control circuit and 117 a frame memory and 113. The processing in the coding equipment of this embodiment is explained according to the flow chart shown in drawing 4.
[0031]In drawing 1, to the frame memory of 101. Identification information (configuration information) for the dynamic image data or each frame which passed through editing work to identify a background image field and an object image field for said each [which constitutes each frame of the dynamic image data which comprises two or more independent hierarchies, and each of said original image data] hierarchy of every is memorized.
[0032]First, the original image data which is an object of coding is chosen and read from the frame memory 101 by control of the control circuit 116. It is parallel to the blocking treatment to the selected original image data in the blocking circuit 102, and the control circuit 116 detects the configuration information corresponding to the hierarchy in whom each block from the blocking circuit 102 is located.
[0033]The result of having searched the configuration information corresponding to the above-mentioned picture of each hierarchy who constitutes each frame read from the frame memory 101, When the configuration information corresponding to a hierarchy's above-mentioned picture is detected, the configuration information corresponding to the picture of each hierarchy who constitutes said each frame is read from the frame memory 101, and it is made to memorize to the profiling information buffer 119 by control of the control circuit 116.
[0034]Said configuration information is parallel with the picture of the hierarchy applicable to said configuration information being read by control of the control circuit 116, It is constituted so that it may bundle up per frame and may be written in the profiling information buffer 119, and read-out of said configuration information from the frame memory 101 and the writing to the profiling information buffer 119 are repeated whenever a hierarchy's picture is coded.
[0035]The original image data which was chosen by control of the control circuit 116 and read from the frame memory 101 on the other hand is inputted into the blocking circuit 102, it is divided into predetermined size (nxm n, m: constant), and all processings after this make said block a unit. That is, the flow chart shown in drawing 4 is a flow chart of processing by a block unit.
[0036]The original image data (blocked image data) divided into the block unit is inputted into the edge detection circuit 120. It changes with existence of the configuration information corresponding to this inputted block image data, and processing in the edge detection circuit 120 to the inputted blocked image data is performed using the edge detection circuit 120 of the structure shown in drawing 2 by this embodiment about edge detection.
[0037]Therefore, the existence of the configuration information corresponding to the inputted above-mentioned block image data is checked first (Step S402).
[0038]The configuration information corresponding to the blocked image data inputted into the edge detection circuit 120 is ending with detection, and when the profiling information buffer

119 memorizes, the edge detection process in the edge detection circuit 120 is not performed.
[0039]On the other hand, when the configuration information corresponding to the blocked image data inputted into the edge detection circuit 120 is not detected, as for the edge detection circuit 120, this blocked image data is stored in the buffer 201 by control of the control circuit 116.
[0040]Here, according to the flow chart of the detection processing of the edge information shown in drawing 5 (a), the processing (Step 403) in the edge detection circuit 120 is explained, referring to drawing 2.
[0041]The blocked image data memorized to the buffer 201 is suitably inputted into the DCT (discrete cosine transform) processing circuit 202 (Step S501a), and is changed into a DCT coefficient (Step S502a).
[0042]The blocked image data changed into the DCT coefficient is memorized by a block unit by control of the controller 206 in the cell of the selected memory 203. The above processing is performed about a whole block (Step S503a, Step S504a).
[0043]The DCT coefficient for every block memorized to the memory 203 is read by control of the controller 206, and is inputted into the edge detection section 204. The edge detection section 204 evaluates the frequency spectrum of each blocked image data which continues in two dimensions (Step S505a), presumes the edge over two or more blocks, and generates edge information (Step S506a). The generated edge information is inputted into the profiling information generating circuit 205, and forms and (Step S404) outputs the profiling information (edge map) for every hierarchy which constitutes each frame of an original image (Step S405).
[0044]At this time, the edge map generated in the profiling information generating circuit 205 is outputted to the profiling information buffer 119 and the motion prediction circuit 117. The edge map inputted into the profiling information buffer 119 is available when the prediction reference of the frame (hierarchy) picture which is memorized as substitution of the configuration information which does not exist in an original image, and serves as the present coding subject is carried out.
[0045]The edge detection circuit 300 which has the structure shown in drawing 3 other than the edge detection circuit 120 which has the above structure may be used.
[0046]First, when the configuration information corresponding to the blocked image data inputted into the edge detection circuit 300 is ending with detection and the profiling information buffer 119 memorizes by the detection processing of the control circuit 116, the edge detection process in the edge detection circuit 300 is not performed.
[0047]On the other hand, when the configuration information corresponding to the blocked image data inputted into the control circuit 116 is not detected, as for the edge detection circuit 300, this blocked image data 300 is stored in the buffer 301 by control of the control circuit 116.
[0048]The flow chart which shows the processing in the edge detection circuit 300 is shown in drawing 5 (b), and is explained.
[0049]Total of the luminance value of all the pixels which the blocked image data memorized to the buffer 301 is read suitably (Step S501b), is inputted into the summing operation machine 302, and constitute the inputted blocked image data is calculated (Step S502b). Total of the luminance value of all the pixels for every calculated block is memorized by a block unit by control of the controller 306 in the cell of the selected memory 303. The above processing is performed about a whole block (Step S503b, Step S504b).
[0050]Total of the luminance value of all the pixels for every block memorized to the memory 303 is read by control of the controller 306, and is inputted into the edge detection section 304. It

is dealt with as a parameter which expresses the dc component of the spatial frequency spectrum concerning the picture of this block in total of the luminance value of all the pixels for every block with the edge detection section 304, The dc component during the block which continues in two dimensions is compared and evaluated (Step S505b), edge detection is performed, and edge information is generated (Step S506b).

[0051]The generated edge information is inputted into the profiling information generating circuit 305, and forms and outputs the profiling information for every hierarchy which constitutes each frame of an original image.

[0052]At this time, the profiling information generated in the profiling information generating circuit 305 is outputted to the profiling information buffer 119 and the motion prediction circuit 117. The profiling information inputted into the profiling information buffer 119 as well as the case of the edge detection circuit 120 which has hereafter the composition shown in drawing 2, It is available when the prediction reference of the frame (hierarchy) picture which is memorized as substitution of the configuration information which does not exist in an original image, and serves as the present coding subject is carried out.

[0053]Next, the control circuit 116 reads the profiling information memorized by the profiling information buffer 119 (Step S406), and inputs it into the motion prediction circuit 117. Operation of this motion prediction circuit 117 is shown in drawing 6, and is explained.

[0054]As described above, profiling information is the configuration information itself, when the configuration information corresponding to an original image exists, and when it does not exist, it is the edge map (drawing 6 (a)) generated in the edge detection circuit 120 as mentioned above. Then, the edge map (drawing 6 (b)) corresponding to the picture used as a motion prediction object is read from the profiling information buffer 119 (Step S407), Comparative evaluation is performed per frame (or hierarchy), and the predicted value MVx (refer to drawing 6 (a)) of the motion vector of the block unit of a frame (or hierarchy) is computed (Step S408).

[0055]The predicted value MVx of the computed motion vector is inputted into the motion vector search circuit 118. In the motion vector search circuit 118, from the inputted motion vector predicted value MVx, compute the motion vector search starting point (refer to drawing 8 (b)), and it centers on the computed motion vector search starting point, It is in the motion vector search range set up arbitrarily, and motion vector search is performed by the same method as a conventional example (Step S409). The motion vector search starting point in this embodiment is defined as the level equivalent to the predicted value MVx of the position lost-motion vector of the present coding target block, and the position offset by the vertical coordinate.

[0056]After determining the motion vector of a coding target block as mentioned above, the processing (Step S410) which uses this motion vector and codes a coding target block is explained using the flow chart shown in drawing 9.

[0057]After determining the motion vector of a coding target block as mentioned above, a coding target block is inputted into the subtractor circuit 103 from the blocking circuit 102 by control of the control circuit 116. The block (prediction reference block) applicable to the position simultaneously specified by the frame (finishing [local decryption]) lost-motion vector corresponding to a coding target block to refer to is determined (Step S901), This prediction reference block is read from the frame memory 111 or 112, and it inputs into the subtractor circuit 103, and subtracts between the pixels to which a prediction reference block corresponds from a coding target block in the subtractor circuit 103, respectively (Step S902).

[0058]The processing after this changes into an orthogonal transformation coefficient block the coding target block used as the difference value (prediction error) block computed in the

subtractor circuit 103 in the DC to AC converter of 104 like a conventional example (Step S903). The coding target block by which coordinate conversion was carried out to the orthogonal transformation coefficient in the orthogonal transformation circuit 104 is inputted into the quantization circuit 105, and carries out quantization processing of each coefficient of a coding target block with a predetermined quantization coefficient (Step S904). The quantization coefficient selection and is arbitrarily controllable by conditions, such as a desired code amount and image quality.
[0059]The coding target block by which quantization processing was carried out is inputted into the variable-length-coding circuit 106, to each coefficient of the coding target block after quantization processing was carried out, gives a variable length code and is outputted (Step S905).
[0060]The coding target block by which quantization processing was carried out simultaneously performs inverse quantization processing by being inputted into the inverse quantizing circuit 107 and carrying out the multiplication of the quantization coefficient used in the quantization circuit 105 to each coefficient of the coding target block after quantization processing was carried out. The coding target block by which the inverse quantization operation was done is inputted into the inverse-orthogonal-transformation circuit 108 in the inverse quantizing circuit 107, Inverse orthogonal transformation which accomplishes the orthogonal transformation processing and the pair in the orthogonal transformation circuit 104 is performed, the local decryption prediction error block which is a block of a prediction error decoded [local] is generated, and it is inputted into the adder circuit 109. The local decryption prediction error block inputted into the adder circuit 109, Addition with the pixel to which the prediction reference block used when searching for a prediction error in the subtractor circuit 103 is again read via the selector switch 114,115c, and a local decryption prediction error block corresponds it by control of the control circuit 116 is performed.
[0061]A prediction reference block and the added local decryption prediction error block are memorized and held via the selector switch 110 as a local decryption block at the frame memory 111 or 112. The frame memory 111,112 is a frame memory with the function to memorize the image data by which local decoding was carried out per frame.
[0062]The local decryption block memorized by the frame memory 111,112, As mentioned above, it is outputted to the motion vector search circuit 117 by control of the control circuit 116 via the selector switch 114,115b to the subtractor circuit 103 via the selector switch 114,115a, respectively at the time of a prediction error operation at the time of motion vector search.
[0063]Embodiment] besides [Even if it applies a still more nearly above-mentioned embodiment to the system which comprises two or more apparatus (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the devices (for example, a copying machine, a facsimile machine, etc.) which consist of one apparatus.
[0064]The purpose of an above-mentioned embodiment the storage (or recording medium) which recorded the program code of the software which realizes the function of an embodiment mentioned above, It cannot be overemphasized that it is attained, also when a system or a device is supplied and the computer (or CPU and MPU) of the system or a device reads and executes the program code stored in the storage. In this case, the function of an embodiment which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute an above-mentioned embodiment. By executing the program code which the computer read, Based on directions of the program code the function of an embodiment mentioned above is not only realized, but, It cannot be

overemphasized that it is contained also when the function of an embodiment which performed a part or all of processing that the operating system (OS) etc. which are working on a computer are actual, and was mentioned above by the processing is realized.
[0065]After the program code read from the storage was written in the memory with which the function expansion unit connected to the expansion card inserted in the computer or the computer is equipped, It cannot be overemphasized that it is contained also when the function of an embodiment which performed a part or all of processing that CPU etc. with which the expansion card and function expansion unit are equipped are actual, based on directions of the program code, and was mentioned above by the processing is realized.
[0066]When applying an above-mentioned embodiment to the above-mentioned storage, the program code corresponding to the flow chart (shown in drawing 4 and 5) explained previously will be stored in the storage.
[0067]
[Effect of the Invention]As explained above, according to this invention, coding processing time and motion compensation accuracy can be raised by coding by using this configuration information in the case of coding of the picture which has profiling information. To the picture which does not have profiling information, profiling information can be extracted from this picture and it can code similarly by using this profiling information.

TECHNICAL FIELD

[Field of the Invention]This invention relates to coding equipment which codes to the image data of each frame of video, a method for the same, and a storage.

PRIOR ART

[Description of the Prior Art]An example of conventional coding equipment is shown in block drawing 7.
[0003]In drawing 7, the buffer memory for original image data and 702 701 A blocking circuit, A subtractor circuit and 704 for 703 an orthogonal transformation circuit and 705 a quantization circuit and 706 A variable-length-coding circuit, 707 -- an inverse quantizing circuit and 708 -- as for a frame memory and 713, an adder circuit and 710,714,715 are [a control circuit and 717] motion vector search circuits a mean value arithmetic circuit and 716 a selector switch and 711,712 an inverse-orthogonal-transformation circuit and 709.
[0004]In drawing 7, the original image data which is a coding subject is stored in the buffer memory 701, is read according to the demand from the control circuit 716, and can be carved into the block (size of nxm) of the size which is equivalent to the unit of coding by the blocking circuit 702.
[0005]All processings after this are performed by this block unit.
[0006]The blocked original image data (blocked image data) is inputted into the vector search circuit 717 in order to determine a motion vector (motion compensation).
[0007]An example of the motion vector searching method in the motion vector search circuit 717 is shown in drawing 8.
[0008]Coding object frame I [in / in drawing 8 (a) / the current time t] (t), reference frame I (t-1) to the coding object frame which showed drawing 8 (a) drawing 8 (b), and drawing 8 (c) show reference frame I (t-2) to the frame shown in drawing 8 (b). The block (block A) of a shadow

area is made into the noticing block in I (t) in drawing 8 (a), and MVc is taken as the motion vector to the block A in I (t-1) of the block A in I (t). In drawing 8 (c), MVp is taken as the motion vector to the block A in I (t-2) of the block A in I (t-1).
[0009]Here, the search method of the motion vector MVc follows the following procedures.
[0010]First, the motion vector MVp shall be detected. And the position which shifted only MVp from the same position as the block A on I (t-1) is searched for, and let this position be the search start starting point.
[0011]Next, the difference absolute value sum which sets the range of predetermined size (retrieving range of a motion vector) as level and a perpendicular direction focusing on the search start starting point, is in this retrieving range and shifts 1 pixel of frames of the predetermined range at a time and for which it asks by the following formulas (each pixel of the block A of sigma|I (t) - each within the limit pixel | of the predetermined range)
It calculates. And the difference absolute value sum of 1 pixel accuracy is compared, and the coordinate value (coordinate value of the position at the upper right of the frame of the range predetermined in the figure) which obtained the minimum is detected. And in within the limit [of said predetermined range] in order to raise the retrieval precision of a motion vector further, A virtual pixel (a pixel value is calculated from the surrounding pixel) is arranged between each pixel, origin twice the resolution of on imagination is prepared within the limit of said predetermined range as a result, and the difference absolute value sum for every size of the block A is calculated like **** within this limit. As a result, it can ask for the motion vector MVc by comparing two or more obtained difference absolute value sums, respectively, and detecting the coordinate value which obtained the minimum.
[0012]In the above motion vector heuristics, I (t-1) shown by drawing 8 (b), By control of the control circuit 716, each pixel of the above-mentioned predetermined range within the limit is read from the frame memory 711 or 712 one by one, and it is inputted into the motion vector search circuit 717 via the selector switches 714 and 715a.
[0013]At this time, with the above-mentioned example, the difference absolute value sum of each pixel of the predetermined range within the limit and the block A of I (t) which were inputted calculates, and, as a result, a motion vector is determined.
[0014]Next, blocked image data is inputted into the subtractor circuit 703. The predicted value (block decoded [local]) simultaneously specified in the motion vector called for in the motion vector search circuit 717 by control of the control circuit 716 is read from the frame memory 711 or 712, It is made to input into the subtractor circuit 703 via the selector switches 714 and 715b, and subtraction treatment is carried out from the blocked image data from the blocking circuit 702.
[0015]After the subtraction result in the subtractor circuit 703 is outputted as a prediction error of the data of an original image, orthogonal transformation of it is carried out in the orthogonal transformation circuit 704.
[0016]After being quantized in the quantization circuit 705, the prediction error by which orthogonal transformation was carried out in the orthogonal transformation circuit 704 is inputted into the variable-length-coding circuit 706, and is given the variable length code based on a predetermined function.
[0017]On the other hand, the prediction error after quantization processing in the inverse quantizing circuit 707 and the inverse-orthogonal-transformation circuit 708. After processing completely contrary to the quantization circuit 705 and the orthogonal transformation circuit 704 is performed, it is added by the same value as the value (predicted value) used when searching

for a prediction error in the subtractor circuit 703, and in the adder circuit 709 as local decryption image data, The frame memory 711 or 712 memorizes via the selector switch 710.
[0018]The frame memory 711,712 is a frame memory with the function to memorize the image data by which local decoding was carried out as mentioned above per frame.
[0019]The block memorized by the frame memory 711,712 decoded [local], As mentioned above, by control of the control circuit 716 at the time of motion vector search. It is similarly outputted to the motion vector search circuit 717 to the adder circuit 709 via the selector switch 714,715c to the subtractor circuit 703 via the selector switch 714,715b via the selector switch 714,715a, respectively at the time of local decoding at the time of a prediction error operation.

EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, according to this invention, coding processing time and motion compensation accuracy can be raised by coding by using this configuration information in the case of coding of the picture which has profiling information. To the picture which does not have profiling information, profiling information can be extracted from this picture and it can code similarly by using this profiling information.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]In [as explained above] conventional coding equipment, Even when coding the picture which has information effective in a motion compensation like the configuration information (profiling information) which identifies a background region and an object image area as represented in MPEG-4 since there is no function to use the information which accompanies original image data, Since the above-mentioned information was not able to be used, it had become shortening of coding processing time, and a neck of improvement in motion compensation accuracy.
[0021]Then, this invention is made in view of the problem of an above-mentioned conventional example, and it is coding by using this configuration information in the case of the coding of a picture which has profiling information, and aims at raising coding processing time and motion compensation accuracy. Also to the picture which does not have profiling information, profiling information is extracted from this picture and it aims at enabling it to code similarly by using this profiling information.

MEANS

[Means for Solving the Problem]In order to attain the purpose of this invention, this invention coding equipment of the one this invention, A storing means which stores the 2nd frame that is coding equipment which codes to image data of each frame of video, and is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said storing means, and Said 2nd frame, A division means to divide the 1st frame into a block which has predetermined size, An extraction means to extract profiling information of an object contained in said 1st frame and said 2nd frame for said every division means **** block, Profiling information of an object contained in said 1st frame extracted by said extraction means, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction means which is a next frame in time than said 1st

frame and which predicts a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising the following from said 1st frame using the motion vector concerned:
A block shown by a motion vector predicted by said prediction means.
An encoding means which codes to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0023]This invention an encoding method of the one this invention, A storing process which stores in a predetermined storing means the 2nd frame that is an encoding method which codes to image data of each frame of video, and is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A partitioning process which divides the 1st frame into a block which has predetermined size, An extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said frame 2 to said frame 1 by a block unit using profiling information of an object contained in said 2nd frame, and. A prediction process which is a next frame in time than said frame 1 of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising the following from said 1st frame using the motion vector concerned:
A block shown by a motion vector predicted at said prediction process.
A coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0024]This invention a storage of the one this invention, It is a storage which stores a program code which functions as coding equipment which codes to image data of each frame of video, A program code of a storing process which stores in a predetermined storing means the 2nd frame that is a front frame in time among each frame of video than the 1st frame, Read said 2nd frame from said predetermined storing means, and Said 2nd frame, A program code of a partitioning process which divides the 1st frame into a block which has predetermined size, A program code of an extraction process of extracting profiling information of an object which depends said ****** and which is contained in said 1st frame and said 2nd frame for every block, Profiling information of an object contained in said 1st frame extracted by said extraction process, Compute a motion vector from said 2nd frame to said 1st frame by a block unit using profiling information of an object contained in said 2nd frame, and. . It is a next frame from said 1st frame using the motion vector concerned in time than said 1st frame. A program code of a prediction process of predicting a motion vector to said 3rd frame by a block unit, and said 3rd frame are characterized by comprising:
A block shown by a motion vector predicted at said prediction process.
A program code of a coding process of coding to a difference value with a block in said 1st frame that corresponds to the block concerned in position.

[0025]As for this invention, coding equipment of the one this invention is characterized by that coding equipment which codes to image data of each frame of video comprises the following.
An extraction means to extract profiling information of an object contained in each frame.
A detection means to detect a motion vector of image data of a coding object frame using

profiling information of an object extracted by said extraction means.
An encoding means which carries out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection means.

[0026]As for this invention, an encoding method of the one this invention is characterized by that an encoding method which codes to image data of each frame of video comprises the following.
An extraction process of extracting profiling information of an object contained in each frame.
A detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process.
A coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process.

[0027]A storage of the one this invention is a storage which stores a program code which functions as coding equipment which codes to image data of each frame of video, A program code of an extraction process of extracting profiling information of an object contained in each frame, A program code of a detection process which detects a motion vector of image data of a coding object frame using profiling information of an object extracted by said extraction process, A program code of a coding process of carrying out the motion compensation coding of the image data of said coding object frame using a motion vector detected by said detection process was stored.
[0028]
[Embodiment of the Invention]According to an accompanying drawing, this invention is explained in detail according to a suitable embodiment below.
[0029][A 1st embodiment] The block diagram showing the composition of the coding equipment in this embodiment is shown in drawing 1.
[0030]In drawing 1, the frame memory for original images and 102 101 A blocking circuit, A subtractor circuit and 104 for 103 an orthogonal transformation circuit and 105 a quantization circuit and 106 A variable-length-coding circuit, 107 an inverse quantizing circuit and 108 an inverse-orthogonal-transformation circuit and 109 An adder circuit, 110,114,115 -- a selector switch and 111,112 -- as for a motion prediction circuit and 118, a mean value arithmetic circuit and 116 are [a profiling information buffer and 120] edge detection circuits a motion vector search circuit and 119 a control circuit and 117 a frame memory and 113. The processing in the coding equipment of this embodiment is explained according to the flow chart shown in drawing 4.
[0031]In drawing 1, to the frame memory of 101. Identification information (configuration information) for the dynamic image data or each frame which passed through editing work to identify a background image field and an object image field for said each [which constitutes each frame of the dynamic image data which comprises two or more independent hierarchies, and each of said original image data] hierarchy of every is memorized.
[0032]First, the original image data which is an object of coding is chosen and read from the frame memory 101 by control of the control circuit 116. It is parallel to the blocking treatment to the selected original image data in the blocking circuit 102, and the control circuit 116 detects the configuration information corresponding to the hierarchy in whom each block from the blocking circuit 102 is located.
[0033]The result of having searched the configuration information corresponding to the above-mentioned picture of each hierarchy who constitutes each frame read from the frame memory

101, When the configuration information corresponding to a hierarchy's above-mentioned picture is detected, the configuration information corresponding to the picture of each hierarchy who constitutes said each frame is read from the frame memory 101, and it is made to memorize to the profiling information buffer 119 by control of the control circuit 116.
[0034]Said configuration information is parallel with the picture of the hierarchy applicable to said configuration information being read by control of the control circuit 116, It is constituted so that it may bundle up per frame and may be written in the profiling information buffer 119, and read-out of said configuration information from the frame memory 101 and the writing to the profiling information buffer 119 are repeated whenever a hierarchy's picture is coded.
[0035]The original image data which was chosen by control of the control circuit 116 and read from the frame memory 101 on the other hand is inputted into the blocking circuit 102, it is divided into predetermined size (nxm n, m: constant), and all processings after this make said block a unit. That is, the flow chart shown in drawing 4 is a flow chart of processing by a block unit.
[0036]The original image data (blocked image data) divided into the block unit is inputted into the edge detection circuit 120. It changes with existence of the configuration information corresponding to this inputted block image data, and processing in the edge detection circuit 120 to the inputted blocked image data is performed using the edge detection circuit 120 of the structure shown in drawing 2 by this embodiment about edge detection.
[0037]Therefore, the existence of the configuration information corresponding to the inputted above-mentioned block image data is checked first (Step S402).
[0038]The configuration information corresponding to the blocked image data inputted into the edge detection circuit 120 is ending with detection, and when the profiling information buffer 119 memorizes, the edge detection process in the edge detection circuit 120 is not performed.
[0039]On the other hand, when the configuration information corresponding to the blocked image data inputted into the edge detection circuit 120 is not detected, as for the edge detection circuit 120, this blocked image data is stored in the buffer 201 by control of the control circuit 116.
[0040]Here, according to the flow chart of the detection processing of the edge information shown in drawing 5 (a), the processing (Step 403) in the edge detection circuit 120 is explained, referring to drawing 2.
[0041]The blocked image data memorized to the buffer 201 is suitably inputted into the DCT (discrete cosine transform) processing circuit 202 (Step S501a), and is changed into a DCT coefficient (Step S502a).
[0042]The blocked image data changed into the DCT coefficient is memorized by a block unit by control of the controller 206 in the cell of the selected memory 203. The above processing is performed about a whole block (Step S503a, Step S504a).
[0043]The DCT coefficient for every block memorized to the memory 203 is read by control of the controller 206, and is inputted into the edge detection section 204. The edge detection section 204 evaluates the frequency spectrum of each blocked image data which continues in two dimensions (Step S505a), presumes the edge over two or more blocks, and generates edge information (Step S506a). The generated edge information is inputted into the profiling information generating circuit 205, and forms and (Step S404) outputs the profiling information (edge map) for every hierarchy which constitutes each frame of an original image (Step S405).
[0044]At this time, the edge map generated in the profiling information generating circuit 205 is outputted to the profiling information buffer 119 and the motion prediction circuit 117. The edge

map inputted into the profiling information buffer 119 is available when the prediction reference of the frame (hierarchy) picture which is memorized as substitution of the configuration information which does not exist in an original image, and serves as the present coding subject is carried out.

[0045]The edge detection circuit 300 which has the structure shown in drawing 3 other than the edge detection circuit 120 which has the above structure may be used.

[0046]First, when the configuration information corresponding to the blocked image data inputted into the edge detection circuit 300 is ending with detection and the profiling information buffer 119 memorizes by the detection processing of the control circuit 116, the edge detection process in the edge detection circuit 300 is not performed.

[0047]On the other hand, when the configuration information corresponding to the blocked image data inputted into the control circuit 116 is not detected, as for the edge detection circuit 300, this blocked image data 300 is stored in the buffer 301 by control of the control circuit 116.

[0048]The flow chart which shows the processing in the edge detection circuit 300 is shown in drawing 5 (b), and is explained.

[0049]Total of the luminance value of all the pixels which the blocked image data memorized to the buffer 301 is read suitably (Step S501b), is inputted into the summing operation machine 302, and constitute the inputted blocked image data is calculated (Step S502b). Total of the luminance value of all the pixels for every calculated block is memorized by a block unit by control of the controller 306 in the cell of the selected memory 303. The above processing is performed about a whole block (Step S503b, Step S504b).

[0050]Total of the luminance value of all the pixels for every block memorized to the memory 303 is read by control of the controller 306, and is inputted into the edge detection section 304. It is dealt with as a parameter which expresses the dc component of the spatial frequency spectrum concerning the picture of this block in total of the luminance value of all the pixels for every block with the edge detection section 304, The dc component during the block which continues in two dimensions is compared and evaluated (Step S505b), edge detection is performed, and edge information is generated (Step S506b).

[0051]The generated edge information is inputted into the profiling information generating circuit 305, and forms and outputs the profiling information for every hierarchy which constitutes each frame of an original image.

[0052]At this time, the profiling information generated in the profiling information generating circuit 305 is outputted to the profiling information buffer 119 and the motion prediction circuit 117. The profiling information inputted into the profiling information buffer 119 as well as the case of the edge detection circuit 120 which has hereafter the composition shown in drawing 2, It is available when the prediction reference of the frame (hierarchy) picture which is memorized as substitution of the configuration information which does not exist in an original image, and serves as the present coding subject is carried out.

[0053]Next, the control circuit 116 reads the profiling information memorized by the profiling information buffer 119 (Step S406), and inputs it into the motion prediction circuit 117. Operation of this motion prediction circuit 117 is shown in drawing 6, and is explained.

[0054]As described above, profiling information is the configuration information itself, when the configuration information corresponding to an original image exists, and when it does not exist, it is the edge map (drawing 6 (a)) generated in the edge detection circuit 120 as mentioned above. Then, the edge map (drawing 6 (b)) corresponding to the picture used as a motion prediction object is read from the profiling information buffer 119 (Step S407), Comparative

evaluation is performed per frame (or hierarchy), and the predicted value MVx (refer to drawing 6 (a)) of the motion vector of the block unit of a frame (or hierarchy) is computed (Step S408).
[0055]The predicted value MVx of the computed motion vector is inputted into the motion vector search circuit 118. In the motion vector search circuit 118, from the inputted motion vector predicted value MVx, compute the motion vector search starting point (refer to drawing 8 (b)), and it centers on the computed motion vector search starting point, It is in the motion vector search range set up arbitrarily, and motion vector search is performed by the same method as a conventional example (Step S409). The motion vector search starting point in this embodiment is defined as the level equivalent to the predicted value MVx of the position lost-motion vector of the present coding target block, and the position offset by the vertical coordinate.
[0056]After determining the motion vector of a coding target block as mentioned above, the processing (Step S410) which uses this motion vector and codes a coding target block is explained using the flow chart shown in drawing 9.
[0057]After determining the motion vector of a coding target block as mentioned above, a coding target block is inputted into the subtractor circuit 103 from the blocking circuit 102 by control of the control circuit 116. The block (prediction reference block) applicable to the position simultaneously specified by the frame (finishing [local decryption]) lost-motion vector corresponding to a coding target block to refer to is determined (Step S901), This prediction reference block is read from the frame memory 111 or 112, and it inputs into the subtractor circuit 103, and subtracts between the pixels to which a prediction reference block corresponds from a coding target block in the subtractor circuit 103, respectively (Step S902).
[0058]The processing after this changes into an orthogonal transformation coefficient block the coding target block used as the difference value (prediction error) block computed in the subtractor circuit 103 in the DC to AC converter of 104 like a conventional example (Step S903). The coding target block by which coordinate conversion was carried out to the orthogonal transformation coefficient in the orthogonal transformation circuit 104 is inputted into the quantization circuit 105, and carries out quantization processing of each coefficient of a coding target block with a predetermined quantization coefficient (Step S904). The quantization coefficient selection and is arbitrarily controllable by conditions, such as a desired code amount and image quality.
[0059]The coding target block by which quantization processing was carried out is inputted into the variable-length-coding circuit 106, to each coefficient of the coding target block after quantization processing was carried out, gives a variable length code and is outputted (Step S905).
[0060]The coding target block by which quantization processing was carried out simultaneously performs inverse quantization processing by being inputted into the inverse quantizing circuit 107 and carrying out the multiplication of the quantization coefficient used in the quantization circuit 105 to each coefficient of the coding target block after quantization processing was carried out. The coding target block by which the inverse quantization operation was done is inputted into the inverse-orthogonal-transformation circuit 108 in the inverse quantizing circuit 107, Inverse orthogonal transformation which accomplishes the orthogonal transformation processing and the pair in the orthogonal transformation circuit 104 is performed, the local decryption prediction error block which is a block of a prediction error decoded [local] is generated, and it is inputted into the adder circuit 109. The local decryption prediction error block inputted into the adder circuit 109, Addition with the pixel to which the prediction reference block used when searching for a prediction error in the subtractor circuit 103 is again

read via the selector switch 114,115c, and a local decryption prediction error block corresponds it by control of the control circuit 116 is performed.
[0061]A prediction reference block and the added local decryption prediction error block are memorized and held via the selector switch 110 as a local decryption block at the frame memory 111 or 112. The frame memory 111,112 is a frame memory with the function to memorize the image data by which local decoding was carried out per frame.
[0062]The local decryption block memorized by the frame memory 111,112, As mentioned above, it is outputted to the motion vector search circuit 117 by control of the control circuit 116 via the selector switch 114,115b to the subtractor circuit 103 via the selector switch 114,115a, respectively at the time of a prediction error operation at the time of motion vector search.
[0063]Embodiment] besides [Even if it applies a still more nearly above-mentioned embodiment to the system which comprises two or more apparatus (for example, a host computer, an interface device, a reader, a printer, etc.), it may be applied to the devices (for example, a copying machine, a facsimile machine, etc.) which consist of one apparatus.
[0064]The purpose of an above-mentioned embodiment the storage (or recording medium) which recorded the program code of the software which realizes the function of an embodiment mentioned above, It cannot be overemphasized that it is attained, also when a system or a device is supplied and the computer (or CPU and MPU) of the system or a device reads and executes the program code stored in the storage. In this case, the function of an embodiment which the program code itself read from the storage mentioned above will be realized, and the storage which memorized that program code will constitute an above-mentioned embodiment. By executing the program code which the computer read, Based on directions of the program code the function of an embodiment mentioned above is not only realized, but, It cannot be overemphasized that it is contained also when the function of an embodiment which performed a part or all of processing that the operating system (OS) etc. which are working on a computer are actual, and was mentioned above by the processing is realized.
[0065]After the program code read from the storage was written in the memory with which the function expansion unit connected to the expansion card inserted in the computer or the computer is equipped, It cannot be overemphasized that it is contained also when the function of an embodiment which performed a part or all of processing that CPU etc. with which the expansion card and function expansion unit are equipped are actual, based on directions of the program code, and was mentioned above by the processing is realized.
[0066]When applying an above-mentioned embodiment to the above-mentioned storage, the program code corresponding to the flow chart (shown in drawing 4 and 5) explained previously will be stored in the storage.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram showing the composition of the coding equipment in a 1st embodiment of this invention.
[Drawing 2]It is a figure showing the structure of an edge detection circuit.
[Drawing 3]It is a figure showing the structure of an edge detection circuit.
[Drawing 4]It is a flow chart of the processing in the coding equipment of a 1st embodiment in this invention.
[Drawing 5]It is a flow chart of the processing in an edge detection circuit.

[Drawing 6]It is a figure showing operation of a motion prediction circuit.
[Drawing 7]It is a block diagram showing an example of conventional coding equipment.
[Drawing 8]It is a figure showing a motion vector search method.
[Drawing 9]It is a flow chart of the processing which codes a coding target block.

[Translation done.]

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(71)出願人　000001007
キヤノン株式会社
東京都大田区下丸子３丁目30番２号

(72)発明者　浜中　章佳
東京都大田区下丸子３丁目30番２号　キヤノン株式会社内

(74)代理人　100076428
弁理士　大塚　康徳　（外２名）

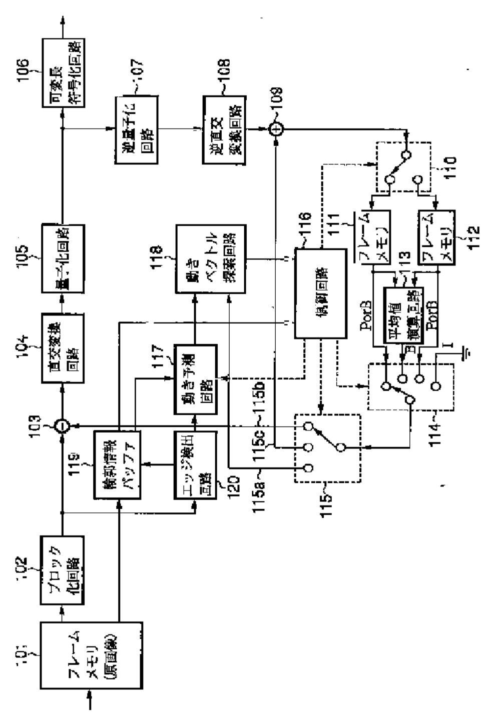
最終頁に続く

(54)【発明の名称】　符号化装置及び符号化方法並びに記憶媒体

(57)【要約】

【課題】　輪郭情報を有する画像の符号化の際に、この形状情報を用いて符号化を行うことで、符号化処理時間や動き補償精度を向上させること。また輪郭情報を有しない画像に対しても、この画像から輪郭情報を抽出し、この輪郭情報を用いることで、同様に符号化を行えるようにすること。

【解決手段】　符号化対象のブロック化画像データに対応した情報の有無を確認し、前記情報が検出されなかった場合、前記ブロック化画像データに対する輪郭情報を形成し、前記ブロック化画像データの動きベクトルの予測値を算出し、前記符号化対象のブロック化画像データと最も類似した第１の領域を求め、前記ブロック化画像データの動きベクトルを算出し、差分値ブロックを符号化し、前記符号化された差分値ブロックを復号化して再度前記記憶手段に格納する。



【特許請求の範囲】

【請求項１】　動画像の各フレームの画像データに対して符号化を行う符号化装置であって、
動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを格納する格納手段と、
前記第２のフレームを前記格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割手段と、
前記分割手段よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出手段と、
前記抽出手段により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報とを用いて、前記第２のフレームから前記第１のフレームへの動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記第１のフレームより時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測手段と、
前記第３のフレームにおいて、前記予測手段で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化手段とを備えることを特徴とする符号化装置。

【請求項２】　前記抽出手段は更に、
前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在するか否かを判断する判断手段と、
前記判断手段により、前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在しない場合、前記第１のフレーム、前記第２のフレームに対してエッジ検出を行い、当該エッジ検出結果を夫々のフレームの前記輪郭情報とするエッジ検出手段とを備えることを特徴とする請求項１に記載の符号化装置。

【請求項３】　前記エッジ検出手段は、前記第１のフレーム、前記第２のフレームに対してＤＣＴ変換を行い、夫々のＤＣＴ係数を評価することで生成されたエッジ情報を用いて、夫々のフレームの前記輪郭情報を生成することを特徴とする請求項２に記載の符号化装置。

【請求項４】　前記エッジ検出手段は、前記第１のフレーム、前記第２のフレーム、夫々の輝度値の総和を求め、この総和を用いて生成されたエッジ情報を用いて、夫々のフレームの輪郭情報を生成することを特徴とする請求項２に記載の符号化装置。

【請求項５】　前記予測手段は更に、
前記第２のフレームから前記第１のフレームへの注目ブロックの動きベクトルに基づいた検索開始点を中心とし、所定のサイズを有する領域を、前記第３のフレームに設定する領域設定手段と、
前記領域設定手段による領域内で、前記注目ブロックと最も類似した領域を、前記注目ブロックに対する予測ブロックとして特定するブロック特定手段と、
前記注目ブロックから前記ブロック特定手段により特定された前記予測ブロックへの動きベクトルを算出する算出手段とを備えることを特徴とする請求項１乃至４のいずれか１項に記載の符号化装置。

【請求項６】　前記各フレームは階層構造を有し、各階層毎に前記輪郭情報が記憶可能であることを特徴とする請求項１乃至５のいずれか１項に記載の符号化装置。

【請求項７】　動画像の各フレームの画像データに対して符号化を行う符号化方法であって、
動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを所定の格納手段に格納する格納工程と、
前記第２のフレームを前記所定の格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割工程と、
前記分割工程よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程と、
前記抽出工程により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報と、を用いて、前記第２のフレームから前記第１のフレームへの動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記第１のフレームより時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測工程と、
前記第３のフレームにおいて、前記予測工程で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化工程とを備えることを特徴とする符号化方法。

【請求項８】　前記抽出工程は更に、
前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在するか否かを判断する判断工程と、
前記判断工程により、前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在しない場合、前記第１のフレーム、前記第２のフレームに対してエッジ検出を行い、当該エッジ検出結果を夫々のフレームの前記輪郭情報とするエッジ検出工程とを備えることを特徴とする請求項７に記載の符号化方法。

【請求項９】　前記予測工程は更に、
前記第２のフレームから前記第１のフレームへの注目ブロックの動きベクトルに基づいた検索開始点を中心とし、所定のサイズを有する領域を、前記第３のフレームに設定する領域設定工程と、
前記領域設定工程による領域内で、前記注目ブロックと

最も類似した領域を、前記注目ブロックに対する予測ブロックとして特定するブロック特定工程と、
前記注目ブロックから前記ブロック特定工程により特定された前記予測ブロックへの動きベクトルを算出する算出工程とを備えることを特徴とする請求項７又は８に記載の符号化方法。
【請求項１０】　動画像の各フレームの画像データに対して符号化を行う符号化装置として機能するプログラムコードを格納する記憶媒体であって、
動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを所定の格納手段に格納する格納工程のプログラムコードと、
前記第２のフレームを前記所定の格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割工程のプログラムコードと、
前記分割工程よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程のプログラムコードと、
前記抽出工程により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報と、を用いて、前記第２のフレームから前記第１のフレームへの動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記第１のフレームより時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測工程のプログラムコードと、
前記第３のフレームにおいて、前記予測工程で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化工程のプログラムコードとを備えることを特徴とする記憶媒体。
【請求項１１】　前記抽出工程のプログラムコードは更に、
前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在するか否かを判断する判断工程のプログラムコードと、
前記判断工程により、前記第１のフレーム、前記第２のフレームにオブジェクトの輪郭情報が存在しない場合、前記第１のフレーム、前記第２のフレームに対してエッジ検出を行い、当該エッジ検出結果を夫々のフレームの前記輪郭情報とするエッジ検出工程のプログラムコードとを備えることを特徴とする請求項１０に記載の記憶媒体。
【請求項１２】　前記予測工程のプログラムコードは更に、
前記第２のフレームから前記第１のフレームへの注目ブロックの動きベクトルに基づいた検索開始点を中心とし、所定のサイズを有する領域を、前記第３のフレームに設定する領域設定工程のプログラムコードと、
前記領域設定工程による領域内で、前記注目ブロックと最も類似した領域を、前記注目ブロックに対する予測ブロックとして特定するブロック特定工程のプログラムコードと、
前記注目ブロックから前記ブロック特定工程により特定された前記予測ブロックへの動きベクトルを算出する算出工程のプログラムコードとを備えることを特徴とする請求項１０または１１に記載の記憶媒体。
【請求項１３】　動画像の各フレームの画像データに対して符号化を行う符号化装置であって、
各フレームに含まれるオブジェクトの輪郭情報を抽出する抽出手段と、
前記抽出手段により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出手段と、
前記検出手段によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化手段と、を備えることを特徴とする符号化装置。
【請求項１４】　動画像の各フレームの画像データに対して符号化を行う符号化方法であって、
各フレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程と、
前記抽出工程により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出工程と、
前記検出工程によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化工程と、を備えることを特徴とする符号化方法。
【請求項１５】　動画像の各フレームの画像データに対して符号化を行う符号化装置として機能するプログラムコードを格納する記憶媒体であって、
各フレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程のプログラムコードと、
前記抽出工程により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出工程のプログラムコードと、
前記検出工程によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化工程のプログラムコードと、を格納したことを特徴とする記憶媒体。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、動画像の各フレームの画像データに対して符号化を行う符号化装置及びその方法並びに記憶媒体に関する。
【０００２】
【従来の技術】従来の符号化装置の一例をブロック図７

に示す。

【０００３】図7に於いて、７０１は原画像データ用のバッファメモリ、７０２はブロック化回路、７０３は減算回路、７０４は直交変換回路、７０５は量子化回路、７０６は可変長符号化回路、７０７は逆量子化回路、７０８は逆直交変換回路、７０９は加算回路、７１０，７１４，７１５はセレクタスイッチ、７１１，７１２はフレームメモリ、７１３は平均値演算回路、７１６は制御回路、７１７は動きベクトル探索回路である。

【０００４】図7に於いて、符号化対象である原画像データは、バッファメモリ７０１に格納され、制御回路７１６からの要求に応じて読み出され、ブロック化回路７０２によって符号化の単位に相当するサイズのブロック（ｎ×ｍのサイズ）に切り分けられる。

【０００５】これ以降の処理はすべてこのブロック単位で行われる。

【０００６】ブロック化された原画像データ（ブロック化画像データ）は、動きベクトルを決定（動き補償）する為にベクトル探索回路７１７に入力される。

【０００７】動きベクトル探索回路７１７に於ける動きベクトル探索方法の一例を図８に示す。

【０００８】図８（ａ）は現在時刻ｔに於ける符号化対象フレームＩ（ｔ）、図８（ｂ）は図８（ａ）に示した符号化対象フレームに対する参照フレームＩ（ｔ－１）、図８（ｃ）は図８（ｂ）に示したフレームに対する参照フレームＩ（ｔ－２）を示す。図８（ａ）において斜線部分のブロック（ブロックＡ）をＩ（ｔ）に於ける注目ブロックとし、ＭＶｃはＩ（ｔ）におけるブロックＡのＩ（ｔ－１）におけるブロックＡに対する動きベクトルとする。また図８（ｃ）において、ＭＶｐは、Ｉ（ｔ－１）におけるブロックＡのＩ（ｔ－２）におけるブロックＡに対する動きベクトルとする。

【０００９】ここで、動きベクトルＭＶｃの検索方法は、以下の手順に従う。

【００１０】まず、動きベクトルＭＶｐが検出されているものとする。そして、Ｉ（ｔ－１）上のブロックＡと同一位置からＭＶｐだけシフトした位置を求め、この位置を探索開始原点とする。

【００１１】次に、探索開始原点を中心に水平、垂直方向に所定のサイズの範囲（動きベクトルの検索範囲）を設定し、この検索範囲内で所定の範囲の枠を１画素ずつシフトして、以下の式で求める差分絶対値和

（Σ｜Ｉ（ｔ）のブロックＡの各画素－所定の範囲の枠内の各画素｜）

を演算する。そして、１画素精度の差分絶対値和を比較して、最小値を得た座標値（同図では所定の範囲の枠の右上の位置の座標値）を検出する。そして更に動きベクトルの検索精度を高めるために、前記所定の範囲の枠内において、各画素間に仮想的な画素（画素値は周囲の画素から計算）を配置し、結果的に前記所定の範囲の枠内に仮想上、元の倍の解像度を用意し、この枠内でブロックＡのサイズ毎の差分絶対値和を上述と同様に演算する。その結果、得られた複数の差分絶対値和をそれぞれ比較して、その最小値を得た座標値を検出することで、動きベクトルＭＶｃを求めることができる。

【００１２】上記のような動きベクトル探索法に於いて、図８（ｂ）で示されるＩ（ｔ－１）は、制御回路７１６の制御によって、前述の所定の範囲の枠内の各画素をフレームメモリ７１１または７１２から順次読み出し、セレクタスイッチ７１４及び７１５ａを介して、動きベクトル探索回路７１７へ入力される。

【００１３】この時、上記一例では入力された所定の範囲の枠内の各画素とＩ（ｔ）のブロックＡとの差分絶対値和が演算され、その結果、動きベクトルを決定する。

【００１４】次にブロック化画像データは、減算回路７０３へ入力される。同時に制御回路７１６の制御により、動きベクトル探索回路７１７にて求められた動きベクトルにて指定される予測値（局部復号済みブロック）をフレームメモリ７１１または７１２から読み出し、セレクタスイッチ７１４および７１５ｂを介して減算回路７０３へ入力させ、ブロック化回路７０２からのブロック化画像データから減算処理する。

【００１５】減算回路７０３に於ける減算結果は、原画像のデータの予測誤差として出力された後、直交変換回路７０４にて直交変換される。

【００１６】直交変換回路７０４にて直交変換された予測誤差は、量子化回路７０５にて量子化された後、可変長符号化回路７０６へ入力され、所定の関数に基づく可変長符号を付与される。

【００１７】一方、量子化処理後の予測誤差は、逆量子化回路７０７及び逆直交変換回路７０８にて、量子化回路７０５、直交変換回路７０４と全く逆の処理を施された後、加算回路７０９にて、減算回路７０３にて予測誤差を求める際に使用した値（予測値）と同一の値が加算され、局部復号化画像データとして、セレクタスイッチ７１０を介してフレームメモリ７１１または７１２に記憶される。

【００１８】フレームメモリ７１１，７１２は、前述のように局部復号された画像データをフレーム単位で記憶する機能を持ったフレームメモリである。

【００１９】フレームメモリ７１１，７１２に記憶された局部復号済みブロックは、前述のように、制御回路７１６の制御により、動きベクトル探索時は、セレクタスイッチ７１４，７１５ａを介して動きベクトル探索回路７１７へ、予測誤差演算時は、セレクタスイッチ７１４，７１５ｂを介して減算回路７０３へ、同様に局部復号時はセレクタスイッチ７１４，７１５ｃを介して加算回路７０９へ、それぞれ出力される。

【００２０】

【発明が解決しようとする課題】以上説明したように、

従来の符号化装置に於いては、原画像データに付随する情報を利用する機能がない為、ＭＰＥＧ－４に代表されるように背景領域と対象画像領域とを識別する形状情報（輪郭情報）のように動き補償に有効な情報を有する画像を符号化する際でも、前述の情報は利用不可能である為、符号化処理時間の短縮や動き補償精度の向上のネックとなっていた。

【００２１】そこで、本発明は上述の従来例の問題点に鑑みてなされたものであり、輪郭情報を有する画像の符号化の際に、この形状情報を用いて符号化を行うことで、符号化処理時間や動き補償精度を向上させることを目的とする。また輪郭情報を有しない画像に対しても、この画像から輪郭情報を抽出し、この輪郭情報を用いることで、同様に符号化を行えるようにすることを目的とする。

【００２２】

【課題を解決するための手段】本発明の目的を達成するために、その一つの本発明の符号化装置は、動画像の各フレームの画像データに対して符号化を行う符号化装置であって、動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを格納する格納手段と、前記第２のフレームを前記格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割手段と、前記分割手段よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出手段と、前記抽出手段により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報とを用いて、前記第２のフレームから前記第１のフレームへの動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記第１のフレームより時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測手段と、前記第３のフレームにおいて、前記予測手段で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化手段とを備えることを特徴とする。

【００２３】また、その一つの本発明の符号化方法は、動画像の各フレームの画像データに対して符号化を行う符号化方法であって、動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを所定の格納手段に格納する格納工程と、前記第２のフレームを前記所定の格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割工程と、前記分割工程よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程と、前記抽出工程により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報とを用いて、前記フレーム２から前記フレーム１への動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記フレーム１より時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測工程と、前記第３のフレームにおいて、前記予測工程で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化工程とを備えることを特徴とする。

【００２４】また、その一つの本発明の記憶媒体は、動画像の各フレームの画像データに対して符号化を行う符号化装置として機能するプログラムコードを格納する記憶媒体であって、動画像の各フレームのうち、第１のフレームよりも時間的に前のフレームである第２のフレームを所定の格納手段に格納する格納工程のプログラムコードと、前記第２のフレームを前記所定の格納手段から読み出し、前記第２のフレームと、第１のフレームとを、所定のサイズを有するブロックに分割する分割工程のプログラムコードと、前記分割工程よるブロック毎に、前記第１のフレーム、前記第２のフレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程のプログラムコードと、前記抽出工程により抽出された、前記第１のフレームに含まれるオブジェクトの輪郭情報と、前記第２のフレームに含まれるオブジェクトの輪郭情報と、を用いて、前記第２のフレームから前記第１のフレームへの動きベクトルをブロック単位で算出すると共に、当該動きベクトルを用いて、前記第１のフレームから、前記第１のフレームより時間的に後のフレームである、前記第３のフレームへの動きベクトルをブロック単位で予測する予測工程のプログラムコードと、前記第３のフレームにおいて、前記予測工程で予測された動きベクトルで示されるブロックと、当該ブロックに位置的に対応する前記第１のフレームにおけるブロックとの差分値に対して符号化を行う符号化工程のプログラムコードとを備えることを特徴とする。

【００２５】また、その一つの本発明の符号化装置は、動画像の各フレームの画像データに対して符号化を行う符号化装置であって、各フレームに含まれるオブジェクトの輪郭情報を抽出する抽出手段と、前記抽出手段により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出手段と、前記検出手段によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化手段とを備えることを特徴とする。

【００２６】また、その一つの本発明の符号化方法は、動画像の各フレームの画像データに対して符号化を行う符号化方法であって、各フレームに含まれるオブジェクク

トの輪郭情報を抽出する抽出工程と、前記抽出工程により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出工程と、前記検出工程によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化工程とを備えることを特徴とする。

【００２７】また、その一つの本発明の記憶媒体は、動画像の各フレームの画像データに対して符号化を行う符号化装置として機能するプログラムコードを格納する記憶媒体であって、各フレームに含まれるオブジェクトの輪郭情報を抽出する抽出工程のプログラムコードと、前記抽出工程により抽出されたオブジェクトの輪郭情報を用いて符号化対象フレームの画像データの動きベクトルを検出する検出工程のプログラムコードと、前記検出工程によって検出された動きベクトルを用いて前記符号化対象フレームの画像データを動き補償符号化する符号化工程のプログラムコードとを格納したことを特徴とする。

【００２８】

【発明の実施の形態】以下添付図面に従って、本発明を好適な実施形態に従って詳細に説明する。

【００２９】［第１の実施形態］本実施形態における符号化装置の構成を示すブロック図を図１に示す。

【００３０】図１に於いて、１０１は原画像用フレームメモリ、１０２はブロック化回路、１０３は減算回路、１０４は直交変換回路、１０５は量子化回路、１０６は可変長符号化回路、１０７は逆量子化回路、１０８は逆直交変換回路、１０９は加算回路、１１０，１１４，１１５はセレクタスイッチ、１１１，１１２はフレームメモリ、１１３は平均値演算回路、１１６は制御回路、１１７は動き予測回路、１１８は動きベクトル探索回路、１１９は輪郭情報バッファ、１２０はエッジ検出回路である。なお、本実施形態の符号化装置における処理を図４に示したフローチャートに従って説明する。

【００３１】図１に於いて、１０１のフレームメモリには、編集作業を経た動画像データ又は各フレームが、複数の独立した階層で構成される動画像データと前記各原画像データの各フレームを構成する前記各階層毎に背景画像領域とオブジェクト画像領域とを識別する為の識別情報（形状情報）が記憶されている。

【００３２】まず、制御回路１１６の制御により、フレームメモリ１０１から符号化の対象である原画像データが選択され、読み出される。ブロック化回路１０２における選択された原画像データに対するブロック化処理と平行して、制御回路１１６はブロック化回路１０２からの各ブロックが位置する階層に対応する形状情報の検出を実施する。

【００３３】フレームメモリ１０１から読み出された各フレームを構成する各階層の前述の画像に対応する形状情報の検索を行った結果、階層の前述の画像に対応する形状情報が検出された場合は、制御回路１１６の制御によって前記各フレームを構成する各階層の画像に対応する形状情報をフレームメモリ１０１から読み出して、輪郭情報バッファ１１９へ記憶させる。

【００３４】前記形状情報は、制御回路１１６の制御により、前記形状情報に該当する階層の画像が読み出されるのと並行して、フレーム単位で一括して輪郭情報バッファ１１９に書き込まれるように構成されており、フレームメモリ１０１からの前記形状情報の読み出し、及び輪郭情報バッファ１１９への書き込みは、階層の画像が符号化される毎に繰り返される。

【００３５】一方、制御回路１１６の制御により選択され、フレームメモリ１０１から読み出された原画像データは、ブロック化回路１０２へ入力され、所定のサイズ（ｎ×ｍ　ｎ，ｍ：定数）に分割され、これ以降の処理はすべて前記ブロックを単位とする。つまり図４に示したフローチャートは、ブロック単位での処理のフローチャートである。

【００３６】ブロック単位に分割された原画像データ（ブロック化画像データ）は、エッジ検出回路１２０へ入力される。入力されたブロック化画像データに対するエッジ検出回路１２０に於ける処理は、この入力されたブロック画像データに対応する形状情報の有無によって異なっており、またエッジ検出については本実施形態では図２に示した構造のエッジ検出回路１２０を用いて行われる。

【００３７】よってまず、前述の入力されたブロック画像データに対応する形状情報の有無を確認する（ステップＳ４０２）。

【００３８】エッジ検出回路１２０に入力されたブロック化画像データに対応する形状情報が検出済みで、かつ輪郭情報バッファ１１９に記憶されている場合には、エッジ検出回路１２０に於けるエッジ検出処理は行われない。

【００３９】一方、エッジ検出回路１２０に入力されたブロック化画像データに対応する形状情報が検出されなかった場合には、エッジ検出回路１２０は制御回路１１６の制御により、このブロック化画像データをバッファ２０１へ記憶させる。

【００４０】ここで、図２を参照しながら、図５（ａ）に示したエッジ情報の検出処理のフローチャートに従って、エッジ検出回路１２０における処理（ステップ４０３）について説明する。

【００４１】バッファ２０１へ記憶されたブロック化画像データは、適宜ＤＣＴ（離散コサイン変換）処理回路２０２へ入力され（ステップＳ５０１ａ）、ＤＣＴ係数に変換される（ステップＳ５０２ａ）。

【００４２】ＤＣＴ係数に変換されたブロック化画像データは、コントローラ２０６の制御により、選択されたメモリ２０３のセルへブロック単位で記憶される。以上

の処理は全ブロックについて行われる（ステップＳ５０３ａ，ステップＳ５０４ａ）。

【００４３】メモリ２０３へ記憶されたブロック毎のＤＣＴ係数は、コントローラ２０６の制御により読み出され、エッジ検出部２０４へ入力される。エッジ検出部２０４は、二次元的に連続する各ブロック化画像データの周波数スペクトルを評価して（ステップＳ５０５ａ）、複数ブロックに跨るエッジを推定し、エッジ情報を生成する（ステップＳ５０６ａ）。生成されたエッジ情報は、輪郭情報生成回路２０５へ入力され、原画像の各フレームを構成する各階層毎の輪郭情報（エッジマップ）を形成し（ステップＳ４０４）、出力する（ステップＳ４０５）。

【００４４】この時、輪郭情報生成回路２０５で生成されるエッジマップは、輪郭情報バッファ１１９と動き予測回路１１７へ出力される。輪郭情報バッファ１１９へ入力されたエッジマップは、原画像には存在しない形状情報の代用として記憶され、現在符号化対象となっているフレーム（階層）画像が予測参照される場合に利用可能となっている。

【００４５】以上の構造を有するエッジ検出回路１２０の他にも、図3に示した構造を有するエッジ検出回路３００を用いてもよい。

【００４６】まず、制御回路１１６の検出処理によって、エッジ検出回路３００に入力されたブロック化画像データに対応する形状情報が検出済みで、かつ輪郭情報バッファ１１９に記憶されている場合には、エッジ検出回路３００に於けるエッジ検出処理は行われない。

【００４７】一方、制御回路１１６に入力されたブロック化画像データに対応する形状情報が検出されなかった場合には、エッジ検出回路３００は、制御回路１１６の制御により、このブロック化画像データ３００をバッファ３０１へ記憶させる。

【００４８】なお、エッジ検出回路３００における処理を示すフローチャートを図5（ｂ）に示し、説明する。

【００４９】バッファ３０１へ記憶されたブロック化画像データは、適宜読み出されて（ステップＳ５０１ｂ）、総和演算器３０２へ入力され、入力されたブロック化画像データを構成する全画素の輝度値の総和を演算する（ステップＳ５０２ｂ）。演算されたブロック毎の全画素の輝度値の総和は、コントローラ３０６の制御により、選択されたメモリ３０３のセルへブロック単位で記憶される。以上の処理は全ブロックについて行われる（ステップＳ５０３ｂ，ステップＳ５０４ｂ）。

【００５０】メモリ３０３へ記憶されたブロック毎の全画素の輝度値の総和は、コントローラ３０６の制御により読み出され、エッジ検出部３０４へ入力される。エッジ検出部３０４では、ブロック毎の全画素の輝度値の総和をこのブロックの画像に関する空間周波数スペクトルの直流成分を表すパラメータとして取り扱い、二次元的に連続するブロック間の直流成分を比較・評価し（ステップＳ５０５ｂ）、エッジ検出を行い、エッジ情報を生成する（ステップＳ５０６ｂ）。

【００５１】生成されたエッジ情報は、輪郭情報生成回路３０５へ入力され、原画像の各フレームを構成する各階層毎の輪郭情報を形成して出力する。

【００５２】この時、輪郭情報生成回路３０５で生成される輪郭情報は、輪郭情報バッファ１１９と動き予測回路１１７へ出力される。以下、図２に示した構成を有するエッジ検出回路１２０の場合と同様に、輪郭情報バッファ１１９へ入力された輪郭情報は、原画像には存在しない形状情報の代用として記憶され、現在符号化対象となっているフレーム（階層）画像が予測参照される場合に利用可能となっている。

【００５３】次に制御回路１１６は、輪郭情報バッファ１１９に記憶されている輪郭情報を読み出して（ステップＳ４０６）、動き予測回路１１７へ入力する。この動き予測回路１１７の動作を図6に示し、説明する。

【００５４】前記したように輪郭情報は、原画像に対応する形状情報が存在した場合は、その形状情報そのものであり、存在しなかった場合は、前述のように、エッジ検出回路１２０にて生成されたエッジマップ（図6（ａ））である。続いて動き予測対象となる画像に対応するエッジマップ（図６（ｂ））を輪郭情報バッファ１１９から読み出し（ステップＳ４０７）、フレーム（又は階層）単位で比較評価を行い、フレーム（又は階層）のブロック単位の動きベクトルの予測値ＭＶｘ（図6（ａ）参照）を算出する（ステップＳ４０８）。

【００５５】算出された動きベクトルの予測値ＭＶｘは、動きベクトル探索回路１１８へ入力される。動きベクトル探索回路１１８では、入力された動きベクトル予測値ＭＶｘから、動きベクトル探索開始点（図８（ｂ）参照）を算出し、算出された動きベクトル探索開始点を中心として、任意に設定された動きベクトル探索範囲内で従来例と同様な方法にて動きベクトル探索を行う（ステップＳ４０９）。なお、本実施形態に於ける動きベクトル探索開始点は、現在の符号化対象ブロックの位置から動きベクトルの予測値ＭＶｘに相当する水平、垂直座標分オフセットした位置と定義する。

【００５６】以上のようにして、符号化対象ブロックの動きベクトルが決定した後に、この動きベクトルを用いて符号化対象ブロックの符号化を行う処理（ステップＳ４１０）について、図9に示したフローチャートを用いて説明する。

【００５７】以上のようにして、符号化対象ブロックの動きベクトルが決定した後、制御回路１１６の制御により、符号化対象ブロックをブロック化回路１０２から減算回路１０３へ入力する。同時に符号化対象ブロックに対応する参照するフレーム（局部復号化済み）から動きベクトルで指定される位置に該当するブロック（予測参

照ブロック）を決定し（ステップＳ９０１）、この予測参照ブロックをフレームメモリ１１１または１１２から読み出して、減算回路１０３へ入力し、減算回路１０３において符号化対象ブロックから予測参照ブロックのそれぞれ対応する画素間で減算を行う（ステップＳ９０２）。

【００５８】これ以降の処理は従来例と同様に、減算回路１０３にて算出された差分値（予測誤差）ブロックとなった符号化対象ブロックを１０４の直交変換器にて直交変換係数ブロックに変換する（ステップＳ９０３）。直交変換回路１０４にて直交変換係数に座標変換された符号化対象ブロックは量子化回路１０５に入力され、符号化対象ブロックの各係数を所定の量子化係数にて量子化処理する（ステップＳ９０４）。量子化係数は、所望の符号量、画質等の条件により任意に選択、制御可能である。

【００５９】量子化処理された符号化対象ブロックは可変長符号化回路１０６へ入力され、量子化処理された後の符号化対象ブロックの各係数に対して可変長符号を付与して出力される（ステップＳ９０５）。

【００６０】同時に量子化処理された符号化対象ブロックは逆量子化回路１０７へ入力され、量子化処理された後の符号化対象ブロックの各係数に対して、量子化回路１０５で使用した量子化係数を乗算することにより、逆量子化処理を行う。逆量子化回路１０７にて逆量子化演算された符号化対象ブロックを逆直交変換回路１０８へ入力し、直交変換回路１０４における直交変換処理と対を成す逆直交変換を行い、予測誤差の局部復号済みブロックである局部復号化予測誤差ブロックを生成して、加算回路１０９に入力される。加算回路１０９に入力された局部復号化予測誤差ブロックは、減算回路１０３にて予測誤差を求める際に使用した予測参照ブロックを制御回路１１６の制御により、セレクタスイッチ１１４，１１５ｃを介して再度読み出し、局部復号化予測誤差ブロックの対応する画素との加算を行う。

【００６１】予測参照ブロックと加算された局部復号化予測誤差ブロックは、局部復号化ブロックとして，セレクタスイッチ１１０を介してフレームメモリ１１１または１１２に記憶・保持される。フレームメモリ１１１，１１２は、局部復号された画像データをフレーム単位で記憶する機能を持ったフレームメモリである。

【００６２】フレームメモリ１１１，１１２に記憶された局部復号化ブロックは、前述のように、制御回路１１６の制御により、動きベクトル探索時は、セレクタスイッチ１１４，１１５ａを介して動きベクトル探索回路１１７へ、予測誤差演算時は、セレクタスイッチ１１４，１１５ｂを介して減算回路１０３へそれぞれ出力される。

【００６３】［他の実施形態］なお、上述の実施形態は、複数の機器（例えばホストコンピュータ、インタフェイス機器、リーダ、プリンタなど）から構成されるシステムに適用しても、一つの機器からなる装置（例えば、複写機、ファクシミリ装置など）に適用してもよい。

【００６４】また、上述の実施形態の目的は、前述した実施形態の機能を実現するソフトウェアのプログラムコードを記録した記憶媒体（または記録媒体）を、システムあるいは装置に供給し、そのシステムあるいは装置のコンピュータ（またはCPUやMPU）が記憶媒体に格納されたプログラムコードを読み出し実行することによっても、達成されることは言うまでもない。この場合、記憶媒体から読み出されたプログラムコード自体が前述した実施形態の機能を実現することになり、そのプログラムコードを記憶した記憶媒体は上述の実施形態を構成することになる。また、コンピュータが読み出したプログラムコードを実行することにより、前述した実施形態の機能が実現されるだけでなく、そのプログラムコードの指示に基づき、コンピュータ上で稼働しているオペレーティングシステム(OS)などが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００６５】さらに、記憶媒体から読み出されたプログラムコードが、コンピュータに挿入された機能拡張カードやコンピュータに接続された機能拡張ユニットに備わるメモリに書込まれた後、そのプログラムコードの指示に基づき、その機能拡張カードや機能拡張ユニットに備わるCPUなどが実際の処理の一部または全部を行い、その処理によって前述した実施形態の機能が実現される場合も含まれることは言うまでもない。

【００６６】上述の実施形態を上記記憶媒体に適用する場合、その記憶媒体には、先に説明した（図４及び５に示す）フローチャートに対応するプログラムコードが格納されることになる。

【００６７】

【発明の効果】以上説明したように、本発明によれば、輪郭情報を有する画像の符号化の際に、この形状情報を用いて符号化を行うことで、符号化処理時間や動き補償精度を向上させることができる。また輪郭情報を有しない画像に対しても、この画像から輪郭情報を抽出し、この輪郭情報を用いることで、同様に符号化を行うことができる。

【図面の簡単な説明】

【図１】本発明の第１の実施形態における符号化装置の構成を示すブロック図である。

【図２】エッジ検出回路の構造を示す図である。

【図３】エッジ検出回路の構造を示す図である。

【図４】本発明における第１の実施形態の符号化装置における処理のフローチャートである。

【図５】エッジ検出回路における処理のフローチャートである。

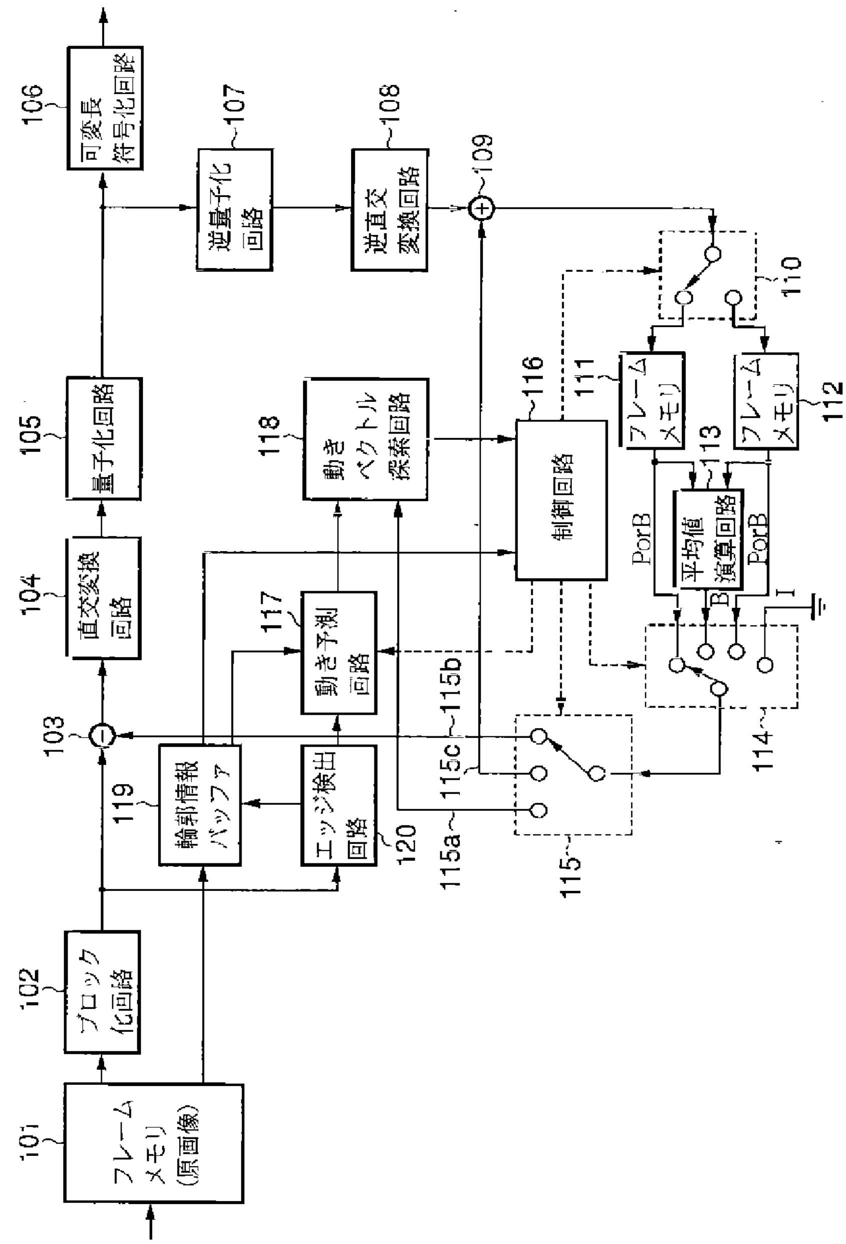
【図６】動き予測回路の動作を示す図である。

【図７】従来の符号化装置の一例を示すブロック図である。

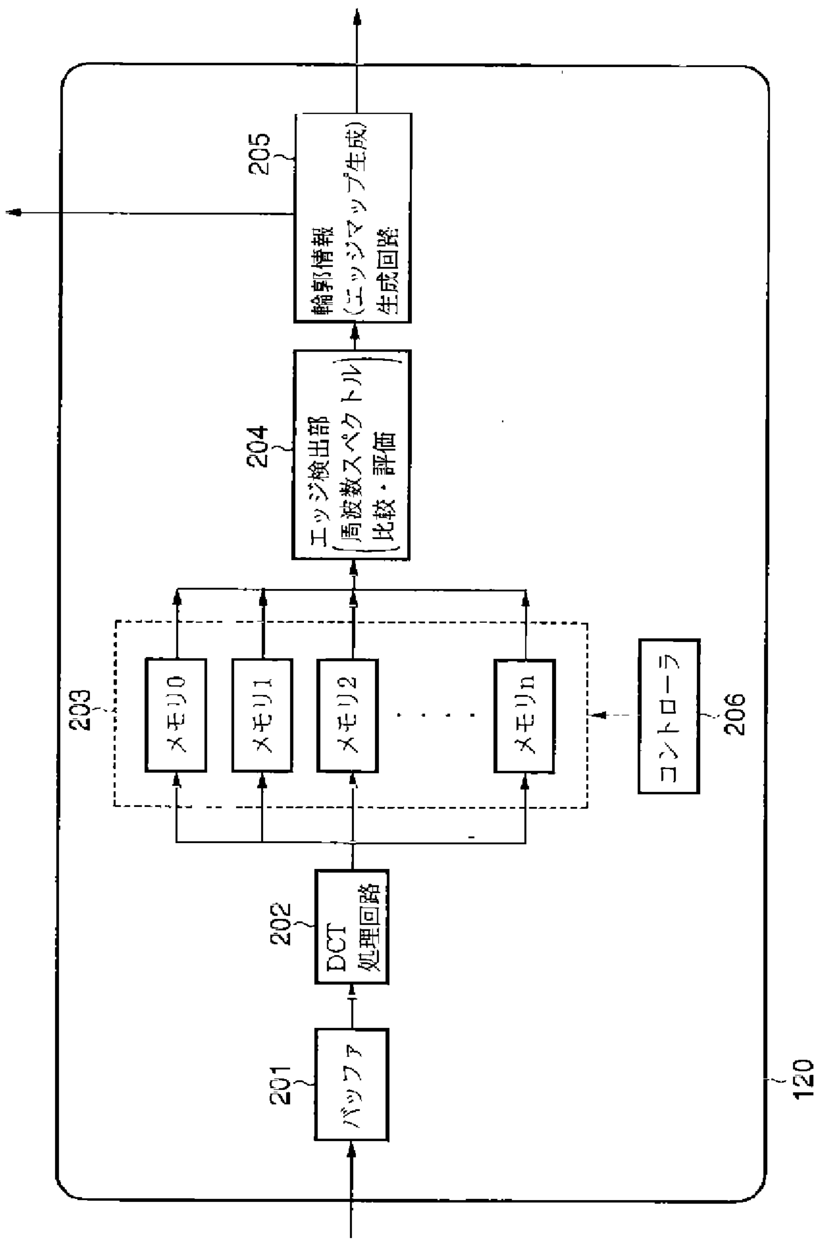
【図８】動きベクトル検索方法を示す図である。

【図９】符号化対象ブロックの符号化を行う処理のフローチャートである。

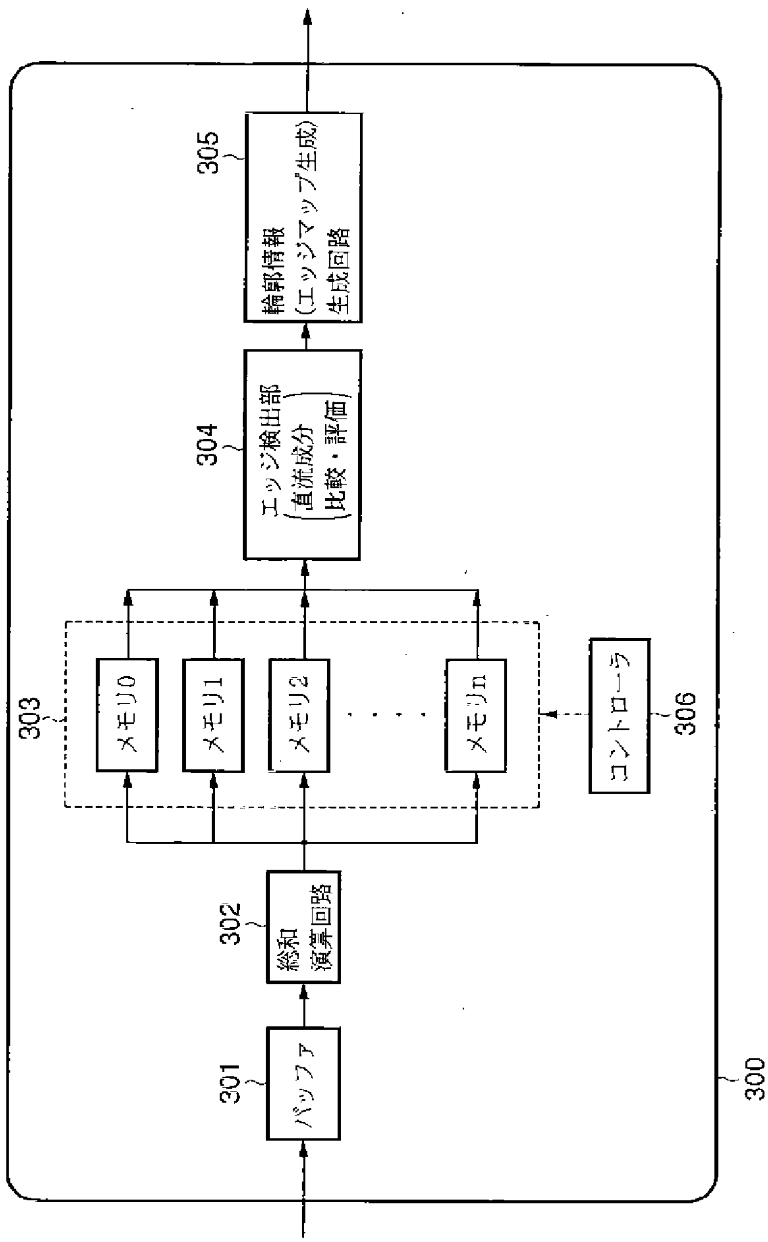
【図１】



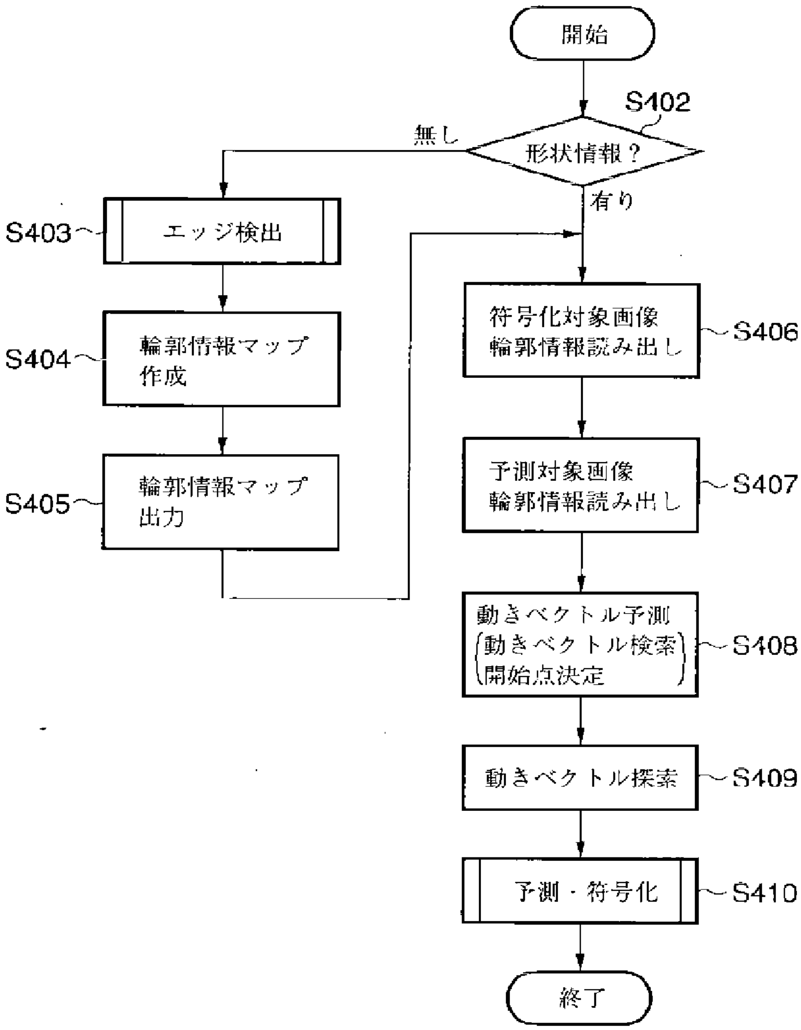
【図2】


バッファ
201
DCT
処理回路
202
メモリ0
メモリ1
メモリ2
メモリn
203
コントローラ
206
エッジ検出部
(周波数スペクトル
比較・評価)
204
輪郭情報
(エッジマップ生成)
生成回路
205
120

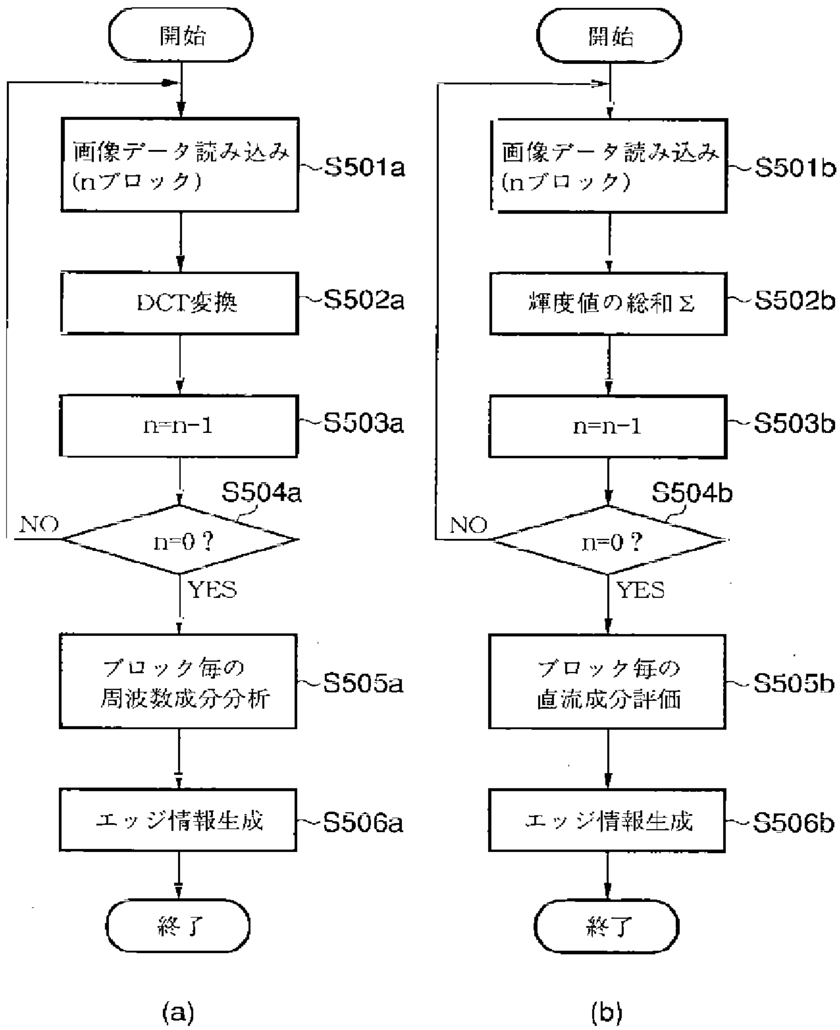
【図3】


300
301
バッファ
302
総和
演算回路
303
メモリ0
メモリ1
メモリ2
メモリn
304
エッジ検出部
(直流成分
比較・評価)
305
輪郭情報
(エッジマップ生成)
生成回路
306
コントローラ

【図4】

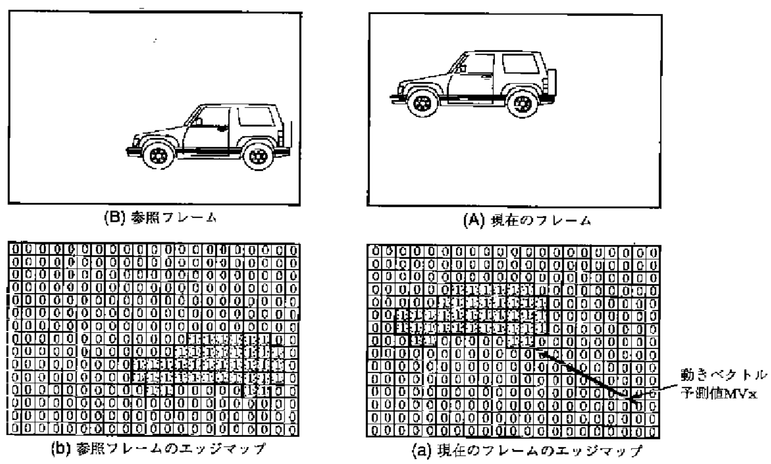

開始
S402
形状情報？
無し
有り
S403
エッジ検出
S404
輪郭情報マップ作成
S405
輪郭情報マップ出力
S406
符号化対象画像輪郭情報読み出し
S407
予測対象画像輪郭情報読み出し
S408
動きベクトル予測
(動きベクトル検索開始点決定)
S409
動きベクトル探索
S410
予測・符号化
終了

【図5】

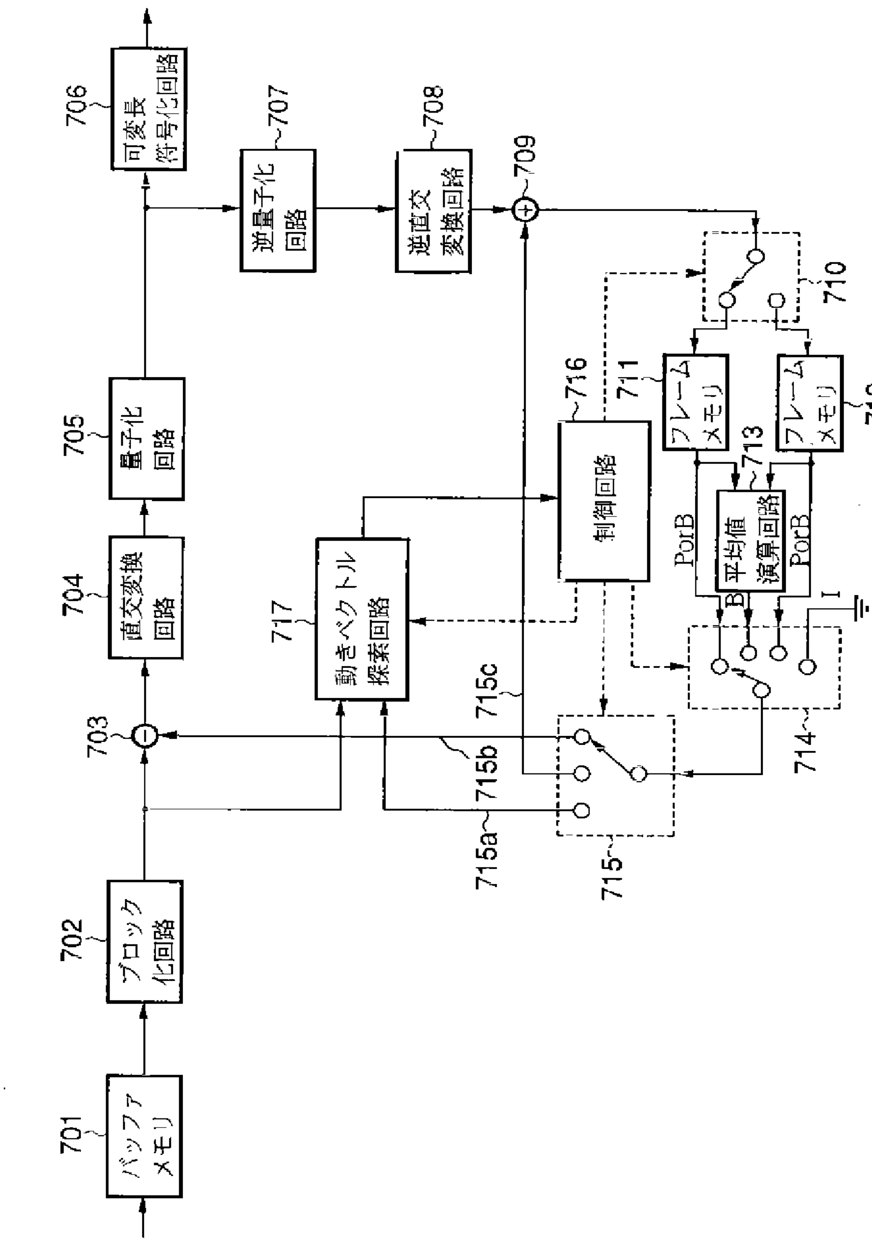


開始
画像データ読み込み (nブロック)
S501a
DCT変換
S502a
n=n-1
S503a
S504a
n=0？
NO
YES
ブロック毎の周波数成分分析
S505a
エッジ情報生成
S506a
終了
(a)
開始
画像データ読み込み (nブロック)
S501b
輝度値の総和Σ
S502b
n=n-1
S503b
S504b
n=0？
NO
YES
ブロック毎の直流成分評価
S505b
エッジ情報生成
S506b
終了
(b)

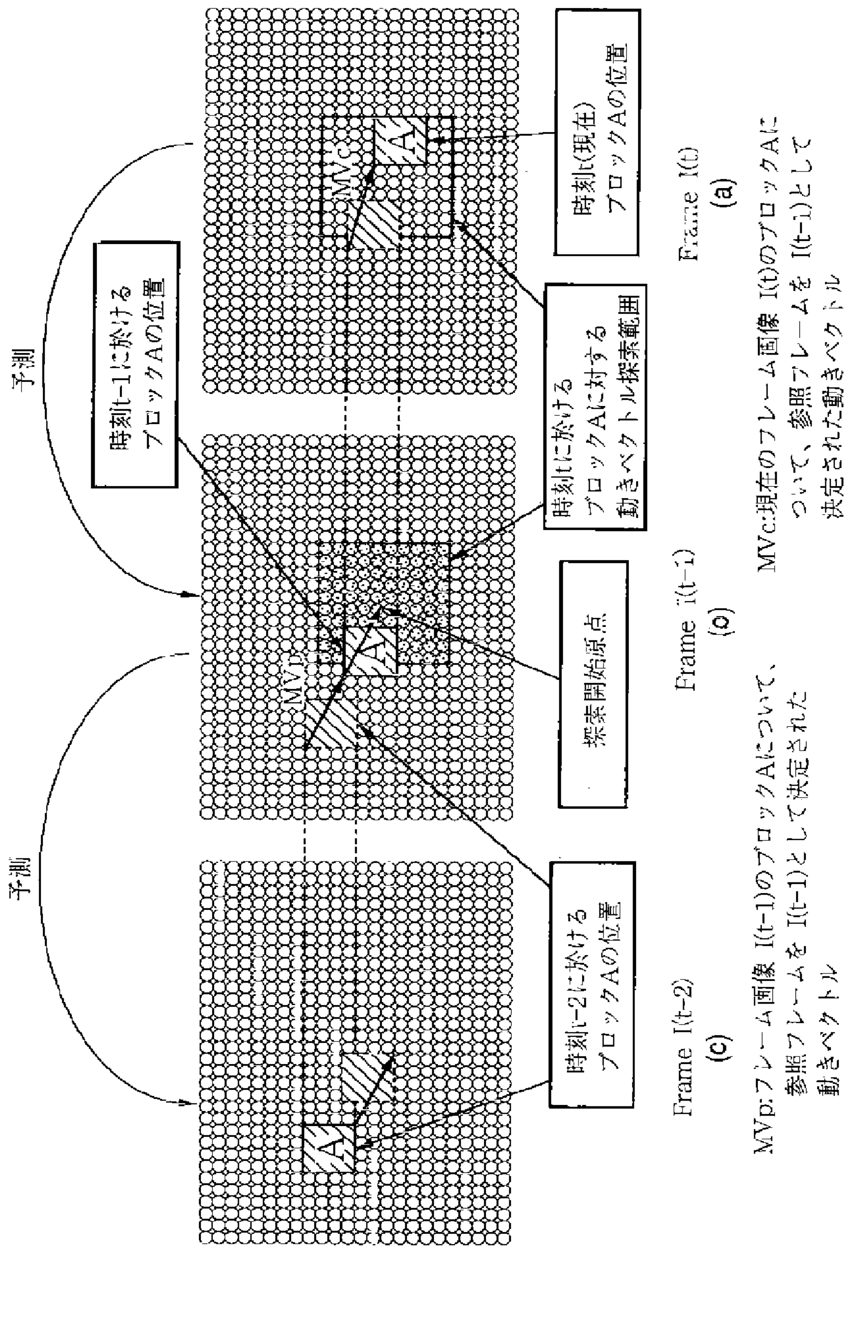
【図6】


(B) 参照フレーム
(A) 現在のフレーム
(b) 参照フレームのエッジマップ
(a) 現在のフレームのエッジマップ
動きベクトル
予測値MVx

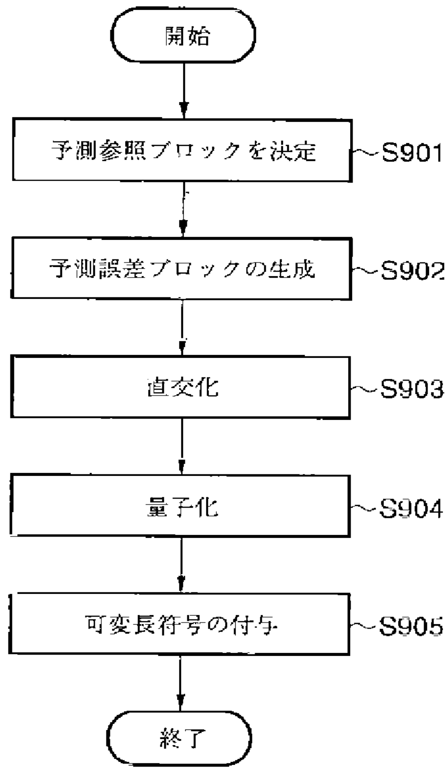
【図7】


701
バッファメモリ
702
ブロック化回路
703
704
直交変換回路
705
量子化回路
706
可変長符号化回路
707
逆量子化回路
708
逆直交変換回路
709
710
711
フレームメモリ
712
フレームメモリ
713
平均値演算回路
PorB
B
PorB
I
714
715
715a
715b
715c
716
制御回路
717
動きベクトル探索回路

【図8】


予測
予測
時刻t-1に於ける
ブロックAの位置
時刻tに於ける
ブロックAに対する
動きベクトル探索範囲
時刻t(現在)
ブロックAの位置
MVc
MVp
A
探索開始原点
時刻t-2に於ける
ブロックAの位置
Frame I(t)
(a)
Frame I(t-1)
(b)
Frame I(t-2)
(c)
MVc:現在のフレーム画像 I(t)のブロックAについて、参照フレームを I(t-1)として決定された動きベクトル
MVp:フレーム画像 I(t-1)のブロックAについて、参照フレームを I(t-1)として決定された動きベクトル

【図9】



フロントページの続き

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HA04